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Office of Critical Infrastructure Protection and Emergency Preparedness

Bureau de la protection des infrastructures essentielles et de la protection civile

STRATEGIC PLANNING GUIDE FOR THE EVACUATION OF A HIGHLY URBANIZED ENVIRONMENT

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INTRODUCTION

This Guide deals with planning and preparing for a decision to evacuate[1] an area in the event of a disaster. A disaster may require radical action to ensure public safety involving the removal of every person from a given sector. Ensuring public safety by this means requires an evaluation of the risks involved, and the consequences for the community, and cannot be made lightly. The managers who make such a decision must have an in-depth knowledge of the community in question and of the means available to them for conducting such a delicate operation successfully.

The primary purpose of this Guide is to demonstrate the need to be adequately prepared and equipped to make a decision about whether to evacuate -- or possibly seal off --, in whole or in part, a sector that is threatened by a disaster or that has already been hit by a disaster. The decision must have been planned long before a disaster actually occurs. If this approach is not taken, the authors believe that the failure to plan will render the evacuation management process and, by extension, the entire process of ensuring public safety much more difficult and expensive.

As a strategy for ensuring public safety, evacuation is a double-edged sword. While it may protect the victims of a disaster, it penalizes the public decision-maker. This paradox is due to the fact that evacuations are always successful in rescuing evacuees, but only at the cost of completely destabilizing them by uprooting them from their homes, their primary universe of reference. For the political or bureaucratic decision-maker, this means that evacuations may save lives but can undermine the physical and psychological integrity of the very people whose lives will be saved. This is the great dilemma posed by evacuation as a response to disaster. The price that must be paid for resorting to evacuation is not insignificant.

To facilitate the task of the planners, particularly city managers, who will ultimately be responsible for responding to an emergency, this report sets out all the operations, tasks and functions to be addressed in making plans that will lead to consistent and optimal decisions taking account of the circumstances of a particular disaster. The Guide accordingly specifies all the stages involved in preparing the information needed and the actions that must be undertaken in order to make an informed judgment on the situation and determine whether an evacuation is necessary, what scope it should have and how it should be carried out. It should be noted that the Guide deals with the planning phase of an evacuation operation, i.e., every kind of response that should be planned before a disaster occurs. The Guide does not explain how to conduct the response or how those involved should or will implement the plan. Similarly, it does not deal with the so-called reintegration or reestablishment phase. It

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[1] Words underlined in the text are defined in the glossary at the end of the guide.

focuses solely on planning for an evacuation, identifying and characterizing the resources for the response and their capacity for effective action should a situation occur where evacuation must be considered. Where resources are identified and a response is planned, it is possible, in the authors' opinion, to make a more informed decision about whether to evacuate a disaster area, a decision with thorny, negative aspects for public authorities and political decision-makers.

Since the overwhelming majority of the risks in a given environment--natural or man-made -- that can cause disasters are found in large urban agglomerations, where most of the economic, social and political activities can be found that define a community's identity and give it its strength, the Guide begins by trying to solve the problem of deciding on an evacuation in a highly urbanized setting. The special nature of an urban setting, by reason of its spatial and demographic configuration and its usually high vulnerability, makes it the laboratory of choice for evaluating the appropriateness and effectiveness of such a strategic planning process. By taking into account the features imposed by such a setting (these features are presented in Chapter 1), the proposed planning model in this Guide may be transferred, with appropriate modifications, to less restrictive evacuation situations -- such as those occurring along waterways or in rural areas.

By reason of the subject-matter and the circumstances in which it is to be applied, this Guide is primarily intended for the various emergency personnel in the municipal world. More specifically, the Guide addresses two clienteles:

- **City and regional elected officials**: mayors, councillors and administrators;
- **Municipal personnel whith a direct role in emergency planning**: managers, planners and emergency response co-ordinators, and local municipal services personnel (police, fire prevention, environment, transportation, health, social services, city planning and so on).

Secondarily, but in keeping with the subject-matter, there are four other groups that will find in this Guide an information tool that complements their current emergency procedures and allows them to be more knowledgeable about the involvement and role of municipal personnel in an evacuation. This in turn will help the four groups interact more effectively.

1. **political decision-makers**: provincial or federal (MPs or MNAs, ministers);
2. **parapublic services**: Red Cross, Salvation Army and other volunteer organizations or non-governmental organizations taking part in emergency evacuation operations or providing services to disaster victims;
3. **services of experts and consultants** in managing emergencies;
4. **risk-generating companies** located within a municipality or urban community.

The Guide will enable municipal and metropolitan officials who are planning operations for

a potential evacuation, regardless of their field of expertise, to know and clearly identify the tasks they will have to perform to lend effective support to the decision-making process when the question of whether to evacuate arises. In addition, the Guide clarifies the roles played by each of the leading players and helps structure adequate and effective partnerships. Finally, the Guide's approach is towards providing a structure for general rather than sectoral planning. This promotes the integration of all components in the emergency response and avoids the subsequent inadequate or fragmented use of resources.

However, the Guide also has some limitations. In the first place, it offers only a general illustration of the planning process. It does not provide an exhaustive description of how things are to be done, what players may be required to respond and what form their particular activities might take. At best, readers will find paths to explore that will allow them to go on to develop a comprehensive strategic plan for their community. Second, although the Guide is intended to apply as generally as possible to a significant number of urban contexts, it cannot claim to apply to all. Therefore, readers must use the principles and proposals with caution and discernment, adapting them as best they can to their own municipal or regional environment. Third, as pointed out above, the Guide proposes strategic planning for evacuations in disaster situations, but it is not a recipe for conducting a response as such, either before, during or after the disaster. These warnings are important because the Guide, it must be remembered, **is to be used in planning** the elements and aspects that must be considered prior to making a decision, and **not for carrying out** the decision as such.

It is divided into five chapters. The first chapter offers a concise presentation of the factors inherent in the phenomenon of evacuation. The second chapter describes the players who are usually involved in disasters and evacuation operations in Canada. Chapter 3 presents strategic planning steps for making a decision to evacuate or, in other words, the stages that must be followed for the best decision-making. Chapter 4 reviews all the tasks that the main municipal intervenors will have to perform leading up to making a decision. The last chapter defines the minimum conditions required for successful strategic planning and discusses the general conclusions that may be drawn from the exercise. Preparation, in relation to the main objective of this Guide, becomes the watchword in terms of decision-making for emergency evacuations.

CHAPTER 1: FACTORS IN AN EVACUATION

Chapter 1 deals with various features or aspects of evacuations. Evacuation is a draconian solution with serious consequences, particularly where it is imposed on a very large number of people or on a high proportion of the population in an area or country. Its consequences are many and various, depending on the aspect of the question that is being considered. Where a total or partial evacuation is ordered that is not absolutely necessary, there will be disruptions over and above the risk that has already materialized, and this will increase public anxiety. Conversely, if the public is told not to evacuate when early forewarning and adequate planning indicate an approaching disaster, the aftermaths of the disaster can be worse than those presented by the original risk. Therefore, it is advisable to take into account all aspects that may be affected by a decision to evacuate a sector and to plan for them before resorting to precipitate, poorly conceived or completely inappropriate action.

The remainder of the chapter will describe the various features of an evacuation, its main elements and the general planning variables to be taken into consideration for each.

1.1 THE PSYCHOLOGICAL CONTEXT

The first and foremost characteristic of an evacuation is the psychological consequences it has on individuals. Removing members of the public from their homes, from their primary and chief frame of reference, imposes varying levels of stress on those who undergo this ordeal. Some react with anxiety, others with anger. Abandoning a familiar environment contradicts the human instinct to remain and protect oneself on the spot. This means that, in evacuating an area, the wishes of the evacuees must be taken into account and adequate measures must be taken to minimize the negative consequences for people. In addition to assessing the potential psychological impact on those who will be evacuated, planning for an evacuation requires anticipating the psychological and social services that will be required to mitigate the impact before, during and, of course, after, the disaster. It also requires that people and groups who are highly vulnerable be alerted from the start to the probability of an evacuation. The following planning variables are proposed as elements of information, performances indicators if one prefers, that may be useful in establishing the potential scope of the consequences of an evacuation from a strictly psychological point of view:

PLANNING VARIABLES:

- LEVEL AND CHARACTERISTICS OF THE PUBLIC'S PHYSICAL AND MENTAL HEALTH;
- FEAR, STRESS AND ANXIETY THAT MAY BE OBSERVABLE IN THE PUBLIC;
- ANGER, FRUSTRATION AND AGGRESSIVENESS THAT MAY BE OBSERVABLE IN THE PUBLIC;
- RATES OF DRUG ADDICTION AND ALCOHOLISM;

- RATE OF MORBIDITY;
- PROMISCUITY/AFFINITIES THAT MAY BE OBSERVABLE AMONG EVACUEES;
- LEVELS AND TYPES OF SERVICES REQUIRED -- BY DISTRICT OR BY PLANNING SECTOR -- IN TERMS OF PSYCHO-SOCIAL NEEDS (psychological, psychiatric, social workers, moral support, and so on);
- TYPES OF RELATED SERVICES, BY DISTRICT, IN SUPPORT OF PSYCHO-SOCIAL RESOURCES (care for house pets, protection of property, and so on).

1.2 THE DEMOGRAPHIC CONTEXT

While it is true that a negative impact may be observable in any individual from the time he is forced to evacuate, the number of people who have to be removed from a sector and their distribution over a particular area lend a demographic dimension to an evacuation operation. Not only will those involved have very personal reactions to the need to evacuate, but the number of individuals at risk is another element that must be considered and assessed. It must be seen where and how people disperse from a danger area -- primarily to identify and note concentrations of people in the area -- in order to establish strategies for ensuring their safety (through evacuation, isolation, and so on). Scenarios must be developed to craft an appropriate response on the basis of these factors. Also, and especially if the number of persons to be evacuated is large, knowledge of how the population will disperse if there is an evacuation (where the evacuees will be relocated) is also important when the time comes to let them return home. Certain variables may also be taken into account in order to form a better idea of the demographic characteristics of the particular sector and to prepare subsequent evacuation scenarios that meet requirements:

PLANNING VARIABLES:

- TOTAL POPULATION (by city, district or planning sector);
- GENERAL POPULATION DENSITY;
- POPULATION DENSITY BY SECTOR (scale of concentrations);
- POPULATION (daytime and nighttime; weekdays and weekends; residential and tourist) IN A PLANNING AREA.

1.3 THE SOCIOLOGICAL CONTEXT

In addition to considering the number of people at risk in a given territory, their social and economic characteristics must be taken into account. People are differentiated not only in

terms of conventional socio-economic variables (age, sex, education, first language, ethnic origin, level of income and so on), but also by less common characteristics or considerations such as family makeup, ownership, network of social contacts and so on. Depending on the scale of the evacuation to be conducted, the number of people to evacuate and their socio-economic profile, an evacuation scenario, perhaps more appropriate or less restrictive, may emerge. The following variables could certainly help managers plan their safety strategy appropriately:

PLANNING VARIABLES:

- POPULATION BY FIRST LANGUAGE (knowledge of the language used in the disaster area);
- POPULATION BY ETHNIC ORIGIN;
- POPULATION BY RELIGION (some religious groups may not be able to follow a specific safety procedure or evacuation in full. In that case, some of their requirements must be taken into consideration);
- POPULATION BY AGE CATEGORIES;
- POPULATION BY SEX;
- POPULATION BY LEVEL OF EDUCATION;
- POPULATION BY INCOME LEVEL;
- HOUSEHOLD SIZE;
- FAMILY SIZE;
- HOUSEHOLD MOBILITY (number of motor vehicles per household);
- RATE OF CRIMINALITY (thefts and vandalism are elements that should be considered so that security resources may be directed to the right places);
- LITERACY RATE (especially useful when communication with disaster victims must be done in writing);
- ANALYSIS OF THE LEVEL AND MEANS OF INFORMATION USED BY THE POPULATION AND THEIR LISTENING HABITS (analysis of the listenership for radio, television, cable T.V., and so on).

1.4 THE TERRITORIAL AND ENVIRONMENTAL CONTEXT

Where a disaster occurs in a large city, the physical and environmental characteristics of the territory and the spatial configuration of the city where the evacuation takes place will directly affect the possible strategic choices and, by the same token, limit the number of operational scenarios. Not only must people be removed from a given area, but the physical and spatial factors specific to that area must also be considered. It will be easily understood that a decision or recommendation to evacuate a large number of people in a city requires a more substantial infrastructure and resources than if the evacuation were to be carried out in a rural or cottage area. In this context, elements such as the space occupied by the urban

territory, the length, width and layout of the streets, building height, their siting, the presence and location of infrastructures and municipal easements, primarily roads, highways and public transportation networks, and the location and dimensions of buildings and land occupied by risk-generating companies, are elements that should be brought to the attention of the decision-makers at the outset to facilitate the devising of possible solutions. Consideration of a number of planning variables, by highlighting the specific characteristics of the urban area to be evacuated, can assist managers to zero in on the kind of evacuation that should be implemented:

PLANNING VARIABLES:

- FUNCTIONS AND USES OF THE LAND INVENTORIED (residential, commercial, administrative, industrial, park and green spaces, public, institutional and community facilities (schools, hospitals, places of worship, penitentiaries, and so on) and public service rights of way (water supply, sewers, electricity, gas, etc.);
- CONSTRUCTION DENSITY AND LAND USE;
- SHAPE AND DIMENSIONS OF BUILDINGS (height, width and depth);
- CHARACTERISTICS OF THE ROAD NETWORK (dimensions, layout, spatial distribution by classes of artery, characteristics of types of public transportation, etc.);
- STRUCTURES RESTRICTING POPULATION MOVEMENT (bridges, viaducts, reserved lanes, one-way streets, underground passages for pedestrians, etc.);
- POLLUTION RATE (level) (air, water, noise) CALCULATED BY SAMPLINGS BEFORE, DURING AND AFTER THE DISASTER;
- LOCATION OF CONTAMINATED AND/OR POTENTIALLY CONTAMINATED AREAS AND AREAS WHERE RISK-GENERATORS ARE CONCENTRATED;
- IDENTIFICATION AND CONCENTRATION OF POLLUTANTS (in the environment of the city or region under consideration, used by companies or released, treated, recovered or recycled by them).

1.5 THE ECONOMIC CONTEXT

Apart from the people and the milieu in which they live, there are also the economic activities that are temporarily disrupted by the disaster. In the case under study, although an evacuation is contemplated and implemented to make the people in a community safe, it has a direct impact on economic activity as a whole. If a sector or city has to be evacuated for a

certain period of time, the result is a temporary cessation of all forms of production, whether industrial, commercial or cultural. It is thus of prime importance to weigh the seriousness of a situation carefully and to measure the impact of the disaster on local economic activity, in order to determine whether the evacuation is absolutely necessary to guarantee the safety of the population. If this measure is decided on too hastily, the temporary desertion of a community could have economic consequences in the weeks following the evacuation (catching up on productivity, short-term decrease in competitive position, harm to reputation, risk of going into debt, etc.). This aspect of a possible evacuation is particularly significant in the case of risk-generating companies that, in such circumstances, will have to implement complex shutdown procedures, which operate slowly and entail often substantial economic costs. The following variables are thus useful for evaluating the economic position of the city, as a whole or by district, and determining the probability of the local economy's derailing in the case of an evacuation:

PLANNING VARIABLES:

- RATE OF ACTIVITY;
- RATE OF UNEMPLOYMENT;
- BREAKDOWN OF THE POPULATION BY OCCUPATION;
- AVAILABILITY AND MOBILITY OF LABOUR FORCE;
- LEVEL OF PRODUCTIVITY OF BUSINESSES BY ACTIVITY SECTOR;
- TYPES OF INDUSTRIAL ACTIVITY IN THE DISTRICT AFFECTED BY THE DISASTER (in particular with regard to shutdown procedures triggered in the event of a disaster).

1.6 THE FINANCIAL AND BUDGETARY CONTEXT

Even though **life is priceless in such circumstances**, the general financial health of the municipality should also be considered. The removal of the population from the sector where the disaster has occurred has effects not only during the evacuation, but also in the later stages (relocation and reestablishment). It is therefore appropriate to see the situation as a whole and to take certain variables into consideration:

PLANNING VARIABLES:

- GENERAL COST OF AN EVACUATION (the services and resources taken all together that will have been required to ensure public safety);
- COST OF MAINTAINING THE EVACUEES OUTSIDE THE DISASTER AREA;

- COST OF THE RETURN OPERATION;
- COMPENSATION FOR EVACUEES;
- THE MUNICIPALITY'S CASH MARGIN;
- THE MUNICIPALITY'S LEVEL OF DEBT;
- THE MUNICIPAL TAX RATE;
- THE MUNICIPALITY'S LINE OF CREDIT.

1.7 THE POLITICAL CONTEXT

Too often, there is a tendency to overlook this aspect of evacuation. While less obvious at the outset, the political aspect involves consequences for the political decision-maker or senior manager. When they make a formal recommendation or decision to evacuate, there are repercussions for their careers and personal reputations. Although the law in Canada does not easily empower elected officials to order an evacuation, any recommendation that a group of politicians might formulate to this effect could seriously impact on their reputation and professional or political future. If the decision-maker, confronted with a disaster, decides to have a sector evacuated that he thinks is threatened and his fears turn out to be unfounded, there are strong chances that the voters will remember this unfortunate episode on the next election day. On the other hand, if that decision-maker fails to act and, by his negligence, places the public in a dangerous situation, his popularity rating could plummet even more radically. In a disaster, although in theory political leaders are essentially concerned with the public good, in practice they may be influenced by considerations of ambition and personal interest. From this it follows that no matter how effective an evacuation might be in terms of its purpose, it poses a number of problems of perception and collective ethics.

1.8 INTEGRATED APPROACH

While deciding to evacuate a threatened sector may ensure the survival of the people in that sector, the consequences the decision may have for the community complicate the decision-making process. Such a decision has more unforeseeable consequences than may appear. To add to the complexity of the problem, planning an evacuation presupposes a variety of tasks and a huge cast of players, all of which will be discussed in the next chapters.

CHAPTER 2: THE PLAYERS AND THEIR ROLES

For the strategic planning of evacuation operations, it is obviously necessary to know what players are likely to be involved. Accordingly, this chapter provides a concise description of the main players and their usual roles. It should be explained that the terminology used here is generic and must be adapted to the specific circumstances of each municipality in its subsequent evacuation planning.

2.1 MUNICIPAL AND METROPOLITAN SERVICES

In the strategic planning and management of local affairs, municipal and metropolitan services, because they are close to residents and community life, are the first to become involved in emergency situations. As soon as a disaster is declared, it is the immediate environment that is placed on alert and mobilized. A number of municipal and metropolitan services are thus given a role in the management -- and by extension, in the planning -- of an evacuation as front-line interveners responsible for core operations. Since it all depends on the legislation in place, the role of the authorities may vary. However, the mayor of the municipality where the evacuation takes place has the ultimate responsibility for choosing this method of ensuring public safety, althouogh he can delegate his decision-making powers to the city manager, the head of the fire prevention services or a person designated as co-ordinator for emergency measures. Other departments do have a mandate to counsel the mayor and make recommendations on the strategy to be adopted. It should also be pointed out that the municipality is responsible for training and informing the public about evacuation and emergency measures (e.g., in respect of warning procedures, the steps to take in case of evacuation or isolation, etc.). From this it follows that the role of the municipal services in terms of evacuation planning continues to be extremely important, in view of their closeness to residents and the community.

2.1.1 CITY AND AREA PLANNING

So that the city or regional planning department can provide decision-makers with as much information as possible about the background of a disaster and its setting, the authorities, prior to the occurrence of any disaster, will have to compile basic information that is as accurate as possible on the urban environment (buildings, urban functions and so on) that will have to be evacuated if the danger becomes urgent. The planning department must continuously collate both qualitative and quantitative information on existing inhabitants, buildings and infrastructures in order to know where people are and where they could possibly be isolated, how the man-made environment is constituted and the roads, routes or arteries by which people can be evacuated when the time comes. This information continues to be crucial when evacuation scenarios must be developed. The work and information generated by the planning department will not be used, strictly speaking, during the

evacuation but collecting and processing data on the subject will add to the information held by the other players and assist in their planning efforts.

2.1.2 *POLICE*

In a city or metropolitan structure affected by a disaster, the police department's primary task is to prevent people from moving around in the disaster area and to protect the sector that has been evacuated while the inhabitants are away, until the all-clear signal has been sounded. Sometimes, where an evacuation is decided on, the city police may be asked to warn the inhabitants and to direct traffic during the general evacuation.

2.1.3 *FIREFIGHTERS/FIRE PREVENTION*

The city's fire department must check the disaster as quickly as possible and rescue people where firefighters have the appropriate equipment (respiratory protective devices, safety clothing, and so on). The fire department could be asked by the mayor to make a decision or recommendation regarding a possible evacuation. Also, if it were necessary to evacuate, the firefighters might be tasked with giving the alarm, providing instructions or assisting others in these tasks.

2.1.4 *TRAFFIC*

As in the city planning department, the traffic department has to provide information on traffic arteries, their capacity, present condition and engineering features (maximum service, apprehended risks of physical damage during an evacuation) in order to determine the best routes for evacuating the population under threat. This information, presented in the form of reports and maps, allows decision-makers to establish and specify various possible evacuation scenarios and their potential feasibility.

2.1.5 *PUBLIC TRANSIT*

Like the traffic department, the public transit department or corporation assists those who do not have private motorized transportation (car, truck, motor cycle), which does not mean that it cannot help others as well. Here again, as with the city planning department, this department should include in reports, maps and scenario software all information governing its network (number and itinerary of routes, level of service and general performance, technical features of its equipment, and so on). Depending on the extent and nature of the evacuation, recourse to conventional public transit routes or interurban routes by pre-established agreements can contribute to activating the evacuation procedure. In some specific circumstances, it is preferable to rely solely on public transit in evacuating a sector. The effectiveness of this measure should be evaluated beforehand.

2.1.6 *PUBLIC WORKS*

The city's public works department responds by setting up a special system of traffic signs

during evacuation operations. It must list the means at its disposal for ensuring that in case of need it can effectively respond to the emergency by making changes to traffic signals and rerouting traffic where the city does not have a traffic department. It must also ensure that the traffic signs meet the route information needs of inhabitants during the actual evacuation.

2.1.7 RECREATION

The city recreation department can organize and manage services to evacuees (registration, information, shelter, clothing, food, general services). If a municipality intends to give this department a significant place in planning its evacuation operations, it should determine what role the department is to play in this regard and negotiate agreements in principle with the agencies empowered to provide these services.

2.1.8 SANITATION AND FOOD

Ordinarily, the primary function of these departments in a city or metropolitan area is to inspect food where food contamination is suspected as a result of a disaster. In addition to this traditional function, municipalities with a sanitation and food department can, as part of their strategic planning for an evacuation, have that department play a planning role for suppliers of food and other basic items for shelters. With the data it is required to keep on food facilities and restaurants, this department can inform decision-makers of potential points of service in sectors identified as reception areas for evacuees. In some cases, this department has taken charge of survival protection operations and pet control.

2.1.9 AMBULANCE SERVICES

In the context of emergency response procedures, the task of the ambulance services is usually to evacuate the wounded or infirm. This includes some of the residents of institutions or reception centres. When a disaster has had a violent impact, the determination of resources in terms of ambulances (numbers available and level of service, first-aid equipment, and so on) becomes vital information for assessing whether the service will be adequate to handle the casualties.

2.1.10 EDUCATIONAL FACILITIES

The various organizations devoted to education (school boards, colleges and private schools, boarding schools, and so on) and the buildings and property they control can make plans to establish places that could serve as shelters or shelter areas in the case of an evacuation. An inventory of all the buildings should be carried out to determine the capacity of each so that plans can be made for billeting the number of people evacuated. The municipality should establish an agreement in principle with the various educational facilities in its area respecting the use of schools as emergency shelters. It is important to remember that these facilities can serve as intake areas for the evacuees but may also need to be evacuated themselves, which requires further planning. Also, given the strategic social role played by

schools as places where information is exchanged, educational facilities, teachers, students and parents should also be asked to participate in training and information, in emergency measures and more specifically in evacuation procedures.

2.1.11 COMMUNITY AGENCIES AND CHARITIES

Like educational facilities, some community agencies and charities (community centres, militias, seminaries, churches and so on) can assist in an evacuation.

2.1.12 HOST MUNICIPALITIES

Host municipalities are a fundamental element in the strategic planning process for evacuations and must be consulted. Agreements in principle will have to be established with them to provide for the temporary movement of the population from one municipality to another where a disaster requires this. The question should be explored of how services could be shared or exchanged by mutual agreement, how municipal evacuation plans can make allowance for the movement of casualties from one city to another and how the municipal services of two or more cities can work together. That task could be assigned, where it is not already provided for in inter-municipal agreements, to the metropolitan or regional administration involved.

2.2 PROVINCIAL MINISTRIES AND SERVICES

Given the limitations on the human, material and financial resources that municipalities can provide, and the jurisdictional problems and allocation of responsibilities necessary to carry out an evacuation, municipalities have to call on outside help, beginning with other municipalities, and it is highly probable that they will have to seek the expertise of higher levels of government. This is even more true if the disaster proves to be a major one, exceeding the capacities of one municipality, or if the effects of the disaster impact on a significant number of areas of activity and jurisdictions. In such a case, provincial ministries and services would undoubtedly be required to respond rapidly on the spot and in various sectors.

2.2.1 SOCIAL SERVICES

Social services respond first as providers of outside coordination support for the municipality in services to disaster victims (registration, shelter, food, clothing, special services). In an evacuation, social services responders are called on to take charge of the dependent population, initially from a psychological and social perspective, and of anyone who has been affected psychologically by the evacuation process. To do so, the agencies affiliated with the responsible ministry make an inventory of available resources, enter into appropriate service agreements with their partners and develop plans to put psychological and social services in place. These resources can include specialists in the psychological and

social disciplines (psychologists, psychiatrists, psychotherapists, social workers, community workers, and so on).

2.2.2 *HEALTH SERVICES (MEDICAL CLINICS, HOSPITALS, ETC.)*

The ministry of health will be required at the beginning of the disaster to determine how serious the disaster's impact will be on public health by evaluating the risks that have materialized. Generally speaking, as soon as a disaster has been declared, health services are asked to take an active role in rescue activities and will often have an important role to play in an evacuation, especially if the disaster has major physical repercussions on a large segment of the population. An inventory should be conducted of resources in this area to determine their level of effectiveness during an evacuation. For example, in a given area, the entire health infrastructure (hospitals, hospital centres, medical clinics, seniors' residences, community service centres, and so on) and complementary resources (ambulance transport equipment, first aid equipment, and so on) would have to be inventoried, identified and described in order to determine its capacity for action and what constraints there may be with respect to available equipment. In connection with the general evacuation planning that the municipality intends to carry out, each facility should have an evacuation plan of its own that can be integrated into the general planning. In that way, the response can be co-ordinated and the players rapidly involved in an overall evacuation strategy at the centre of the emergency when the need is felt. It should be remembered that, like educational facilities, health facilities can receive evacuees but may also find themselves in a situation where they themselves will have to be evacuated. Their planning, like the municipality's, should take that fact into consideration. Also, each health facility, like the schools, can and should take part in training its personnel and clients in preparation for an evacuation.

2.2.3 *PUBLIC SAFETY/CIVIL PROTECTION MINISTRY*

In disasters, the provincial ministry responsible for public safety or civil protection exercises an advisory role and usually has the very important task of co-ordinating the activities of all provincial responders in the field. The ministry's expertise can help the municipality organize and structure its evacuation operation, advise it on the implementation of its emergency plan depending on the circumstances of the disaster, and support municipal action by locating and mobilizing resources in areas not served by other government resources.

2.2.4 *ENVIRONMENT MINISTRY*

The environment ministry locates, identifies and classifies all risks of an environmental nature in the province and can do this for each of its municipalities. This is the ministry with a mandate to identify possible solutions for each risk so that, in the early hours of a disaster, it can indicate how the situation can be returned to normal and can take an active part on the various co-ordination committees. Its function is thus important since it must, in principle, define for the municipality the level of seriousness of the situation. For the municipality it

acts as a first-order informant and consultant (other ministries -- agriculture, health, lands and forests, and so on -- can be asked to play an analogous role and the nature of the risk will dictate the most appropriate ministerial action. Given the fact that environmental issues are almost omnipresent in an urban setting, the environment ministry will often be called out anyway).

2.2.5 *COMMUNICATIONS MINISTRY*

Although the municipality is always the leader and ultimate decision-maker in its communications strategy, the provincial communications ministry's task is to support the municipality from a communications perspective on the basis of a negotiated agreement and to serve as the official spokesman of the provincial government if the province puts response measures in place to deal with an emergency situation. The communications ministry must develop appropriate communication strategies and means to maximize the transmission of messages and information to the appropriate audience, whether within the internal decision-making structure or on the outside, with the victims of the disaster and the public at large. The ministry and the municipality must identify and locate telecommunications devices (telephones, cell phones, walkie-talkies, radiotransmitters, pagers, computers, the Internet, etc.) and telephone tree lists (directories and phone books) for emergency personnel. The ministry also has a mandate to inform the public and must develop a close relationship with the media for that purpose. It must be able to identify the most efficient information and communication methods and techniques (briefing sessions, press releases, dissemination of memos and dispatches, setting up telephone hot-lines, etc.). Blueprints for the presentation of information must be developed to initiate information presentation and communicate rapidly the essential messages that the municipality wants to transmit (for example, this could consist of prepared forms containing basic information, with blanks to fill in with details of the incident in progress).

2.2.6 *TRANSPORTATION MINISTRY*

In situations where a security perimeter must be evacuated, the transport ministry's main task is to identify what kind of transportation infrastructure is required. This means preparing an inventory of the components of the road network and ensuring that they are usable and effective in the event of an evacuation. In addition, the ministry, together with the provincial police force, must establish an emergency traffic sign system along the roads to assist evacuees in leaving. They must close roads where the danger is considered too great.

2.2.7 *AGRICULTURE MINISTRY*

The provincial agriculture ministry will be responsible for evacuating or protecting livestock in the area and setting up services to care for sick or injured animals. It must also assist the municipality affected by the disaster with food inspection. It should be explained, however, that provincial agricultural ministries are responsible only for farm animals intended for agri-

food production, and not for domestic pets.

2.2.8 *PROVINCIAL POLICE FORCE*

Where an evacuation becomes region-wide and requires the removal of the inhabitants of one city to another city or, at the very least, to a location outside an urban agglomeration, the provincial police force or an equivalent should be asked to intervene, primarily to direct traffic on regional, provincial or national roads. The force will have to participate with the other responders in developing appropriate removal strategies in respect of a variety of foreseeable evacuation scenarios for a particular agglomeration.

2.3 *FEDERAL DEPARTMENTS AND SERVICES*

Federal personnel play a less visible role in emergency responses at the municipal level but can help municipal and provincial authorities in emergency intervention, evacuation and return of the evacuees.[2] Thus, the federal departments of environment, agriculture, transportation, health and defence and agencies such as Emergency Preparedness Canada can play an complementary advisory role or provide logistical support in conjunction with the province for municipal emergency responders and help them improve their strategic planning for evacuation. It must be remembered, however, that since by law they come under provincial responsibility, the municipalities cannot call on federal authorities directly for help, but must first request assistance from the ministry of public safety of the provincial government involved.

2.4 *VOLUNTEER AGENCIES*

While volunteer agencies do not have direct input into the decision-making process, their contribution to the emergency effort is generally indispensable for organizing and implementing services to those affected, mainly during the aftermath of the evacuation and the relocation of the victims to an area considered safe. These agencies can also serve as go-betweens between municipal authorities and provincial ministries, or can complement the work of the emergency responders whose efforts might not suffice at one time or another during the response. Also, non-governmental organizations (NGOs), depending on the size of their structure at the local level, may offer responses that address the comfort of evacuees and emergency social services.

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[2] Where a federal establishment is a corporate resident of a municipality, a mutual support agreement is possible between the establishment and the municipality (e.g., a military base may be used as a resource support for municipal firefighters, or as a reception centre during an evacuation).

2.4.1 *CANADIAN RED CROSS*

The Canadian Red Cross gets involved in small and medium-sized disasters and emergencies by setting up a range of services for the victims.[3] The Red Cross does not directly plan or carry out evacuations. However, in a situation that involves severe destabilization for the evacuees, any municipal planning for an evacuation should integrate potential Red Cross activities in order to better serve the victims. Thus, the Red Cross can set up information centres that will receive evacuees and inform them of the services available. It can register evacuees and provide information to the families, provide food or meals, temporary and safe shelter or even clothes to evacuees, administer first aid to save lives or limit the severity of injuries and offer moral support to victims. Given the long experience of the Red Cross in this area, a municipality that wants to devise a strategic evacuation plan would benefit from negotiating a service agreement with the Red Cross. This is all the more important since the Red Cross, despite its specialized knowledge, only intervenes at the request of a municipality or other public body and does not direct operations. A municipality that intends to have the Red Cross take part in a potential evacuation should be familiar with the procedures and equipment used by that organization. In addition, the municipality should identify in the resource inventories it prepares of the buildings, equipment and so on that it could make available to the Red Cross for providing services to victims.

2.4.2 *SALVATION ARMY*

Depending on the place and the region, during evacuation operations the Salvation Army usually handles food and clothing for those who have to be evacuated by providing mobile canteens, clothes and beds. The Salvation Army is normally most active during the return phase when people and households who have lost everything must be given help to reorganize their lives. At the municipal or regional level, the Salvation Army is a resource that may usefully be integrated into an evacuation plan, since an evacuation is a circular process that must include the return phase for which measures must be planned. However, the municipality must carefully evaluate what role the Salvation Army can effectively play in its area.

2.4.3 *OTHER ORGANIZATIONS*

The list of volunteer agencies that could be called on in an evacuation situation depends on

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[3] In small and medium-sized disasters, the Red Cross bears all the costs associated with setting up the services made available to disaster victims. However, in large-scale disasters, the Red Cross will not set up services for the victims until an agreement has been reached with the municipality, which must later pay the cost of the services provided.

the circumstances for each municipality and each urban concentration as well as the position occupied by the agencies at the municipal or regional level. It is up to municipalities that decide to use the various community charitable or humanitarian agencies to prepare a list of all such resources in their area and to determine what role each agency can play in an evacuation. Such organizations include volunteer and community associations (St. John Ambulance, Sun Youth, the YMCA, the YWCA, and so on), social clubs (Optimists, Lions, Kiwanis, Knights of Columbus, Daughters of Isabelle, and so on) as well as private associations and foundations (for example, a municipality might ask a local Chamber of Commerce to help evaluate the economic consequences of an evacuation). A number of these groups can act as volunteer pools, primarily in providing services to victims. Ham radio networks can serve as a backup transmission facility for information and warnings to support the efforts of the authorities and media. In the same spirit, snowmobile and trailer clubs can participate in certain circumstances in evacuation or rescue operations.

2.5 RISK-GENERATORS

Although, strictly speaking, they are not responders in an evacuation, this does not mean that risk-generating companies must be excluded from the strategic planning process for evacuations. Precisely because they are familiar with their own facilities, such companies can play a leading role in assessing risks, and the consequences should the latter materialize. As well, these companies owe a civic duty to the community in which they carry on their activities. They must not only maintain on-going ties with municipal authorities in terms of planning and communication -- they must also include the public in their planning and communications strategy by disseminating information on their products and the risks attached to them and on preliminary safety measures recommended in the case of a disaster (warnings, instructions for isolation or evacuation that tie in with municipal plans, and so on).

2.6 THE EVACUEES THEMSELVES

Lastly, the key players in the entire evacuation planning process are without a doubt the evacuees themselves. As the focus for planning and the reason for this Guide, evacuees are the priority of managers throughout the process. However, the position of the evacuees in the planning process is not limited to a passive, standby role when a disaster strikes. The myth of panic-stricken victims who engage in irrational behaviour as a result of a major upheaval in their environment has held sway too long and has only rarely occurred. The accumulated experience of past evacuations shows, on the contrary, that the victims have an active role to play in the evacuation context which they generally perform in a satisfactory manner. Evacuees help one another get through a confusing situation. Better still, they often take the initiative themselves to evacuate a disaster area. It is therefore of prime importance that a

municipality's evacuation planning take into consideration the role the evacuees should play in this vast process, both as the central subject of the entire planning process and as active and responsible players, eager to ensure their own protection and that of the people around them and to defend their personal integrity.

Now that the cast has been presented, the next chapter will propose a planning model integrating their respective activities.

CHAPTER 3: STAGES IN PLANNING AND DECISION-MAKING

This chapter presents the various stages of planning that must be completed before the best possible decision can be made about an evacuation where a particular kind of disaster has occurred. This means that the process proposed in this chapter must first be articulated in terms of ensuring public safety in areas affected. Evacuation is a possible solution, but after evaluating the specific circumstances surrounding the disaster, the managers may choose other means of ensuring people's safety (such as isolation).

This last point is crucial since, as noted in the introduction and in Chapter 1, evacuation is a draconian solution that should be contemplated only as a last resort. While, for the purpose of this Guide, this approach is proposed for ensuring people's safety, it is not the only solution that may be resorted to. The circumstances in which a disaster occurs and its consequences are the primary determinants of whether an evacuation should be ordered.

In a very schematic fashion, the overall strategic planning process, presented in this chapter as a rigorous, structured activity, endeavours to answer three crucial questions:

> 1 - In a given disaster situation, either apprehended or already at hand, is evacuation desirable?
> 2 - If the answer to the first question is YES, is evacuation feasible?
> 3 - If the answer to the second question is YES, to what extent or according to what scenarios can the evacuation be conducted?

The first question involves knowledge of the milieu in which the response will be launched, and requires an examination and evaluation of the risks, both anticipated and actual, major or secondary, in this particular setting. The second question involves an examination of the context in which the evacuation would be carried out and the resources available to carry it out. The third question involves identifying strategies for conducting the evacuation and, by extension, the scenario promising the greatest effectiveness in terms of maximizing the success of the operation and minimizing costs, risks and losses. That, by and large, is the purpose of this model.

Table 1 presents a strategic planning model for successful decision-making and an implementation process for conducting an evacuation. The process can be divided into three main phases, with nine stages, some of which can be further divided into sub-stages depending on the purpose of the task that must be accomplished. It should be remembered that this is a *planning model* since its only function is to construct a schedule for performing the multiple tasks involved in gathering all the information necessary to make an informed decision subsequently and to implement the desired action when the time comes. Once all the

information banks established by the planning process are put into operation, it will be possible in a disaster to define the limits of the danger at the heart of the disaster, the characteristics of the risk to which particular attention must be paid and to determine, in terms of these characteristics, what scenarios are possible for the remainder of the operations.

It must be pointed out at the outset that the terminology used in Table 1 can designate two scales of planning: where *a system* and *sub-systems* are involved, these terms can designate, respectively, an urban agglomeration (i.e., a metropolitan area and the cities in it), or one of the cities in the area and its districts. Similarly, the word component designates any physical element (place, terrain, building, etc.) or logistical element (equipment, infrastructure, materiel, function or activity) contained in the system or sub-system under consideration (the district, city or urban agglomeration, as the case may be).

The terminology for the suggested model will thus depend on the level of detail sought by the managers in organizing the planning. It is obviously not essential to keep to these definitions. However, it is preferable that the players in a given planning process adopt common definitions. Starting from the general terms as they have just been defined, the rest of the chapter will analyze the proposed planning model.

PLANNING PHASE

3.1 *CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION)*

Basic to planning for a potential evacuation from an urban agglomeration is the recognition, identification and description of the features of that agglomeration and the cities that make it up. The overall characterization is obviously based on knowledge as exhaustive and reliable as possible of the territory in question and its specific features. Generally speaking, the characterization stage involves making a general analysis of the inherent risks and evaluating the vulnerability of the system under consideration (the city or agglomeration).

The first stage therefore entails identifying every risk in each sector of the city or agglomeration for which evacuation measures are planned. To do this, the first phase of the work is subdivided into three sub-stages:

3.1.1 *IDENTIFYING EACH SUB-SYSTEM IN THE AGGLOMERATION (CITIES OR DISTRICTS/PLANNING SECTORS)*

The first sub-stage supposes that managers will divide the municipal or metropolitan area into planning sectors and, on the basis of existing information, will look at all urban activities to establish an analytical and planning framework. An initial cartographical

analysis is an essential step in planning. The sectors will obviously be categorized in various ways depending on the particular features of each metropolitan area and existing municipal services. Following the terminology usually employed by city planners and municipal planners, the kinds of functions and occupations in the cities and their environment are identified as residential, commercial, administrative (office activities), industrial, road networks, network of municipal infrastructures (water supply, sewers, communications, electrical and natural gas easements, public and city property, etc.), public and institutional facilities (parks, schools, churches, hospitals, penitentiaries, health clinics, community, cultural and sports centres, etc.). This urban environment includes other services and networks (health, social services, police, fires, ambulance service, communications activities, professional services, etc.) whose nature and role must be characterized and whose components must be identified in anticipation of a potential evacuation. What must be done is to collect statistics on every function or field of activity in every planning sector in which the main players are involved. In short, a broad overview of each sector within the system under consideration must be prepared (whether a city in an agglomeration or a district within a city).

TABLE 1: STAGES IN THE PLANNING AND DECISION-MAKING PROCESS

Phase	Principle stage	Sub-stages
PLANNING	**3.1** - Characterizing the system at risk (city or urban agglomeration)	**3.1.1** - Identifying each sub-system in the agglomeration (cities or districts/planning sectors) **3.1.2** - Identifying and characterizing components of each city and district (or planning sector) **3.1.3** - Identifying and characterizing existing risks in each city and district (or planning sector)
	3.2 - Identification and analysis of sectors with high disaster potential (cities in the agglomeration or districts in the city)	**3.2.1** - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified **3.2.2** - Study and evaluation of mitigation measures for each risk identified
DECISION	**3.3** - Scripting/simulation/analysis of the stricken area(s) and the risk that produced the disaster	
	3.4 - Developing emergency response scenarios for the disaster and for secondary risks and effects either present or anticipated (evaluating options)	
	3.5 - Determining the best response scenario according to the nature of the disaster and of present or anticipated secondary risks (evaluating options)	**3.5.1** - Study possible evacuation response scenarios **3.5.2** - Analysis of actual secondary risks and their evolution over time **3.5.3** - Choice of the best response scenario **3.5.4** - Study of mitigation measures for secondary risks in the disaster **3.5.5** - Proposal for mitigation measures appropriate for the chosen scenario
	3.6 - Making the decision or recommendation	
RESPONSE	**3.7** - Dissemination/implementation of the decision or recommendation	**3.7.1** - Dissemination of the decision internally and externally **3.7.2** - Establishment of logistical measures to support evacuation operations
	3.8 - Follow-up/monitoring/evaluating the chosen response strategy	
	3.9 - Revisiting the decision or recommendation	

3.1.2 IDENTIFYING AND CHARACTERIZING COMPONENTS OF EACH CITY AND DISTRICT (OR PLANNING SECTOR)

The second sub-stage requires more research. The planners, after inventorying all the elements that make up the system and the sub-systems under analysis, must make a detailed review of all the components of these planning sectors. By "components" is meant all the infrastructures, buildings, equipment, materiel, existing and available resources, procedures and agreements linked to each function in each planning sector. It is extremely important to be very familiar with the resources associated with the urban activities in the sectors in order to determine the level of performance and organizing capacity that can be expected of the sectors in the event of a disaster. This will be particularly essential for determining whether an evacuation strategy can be conducted with success or on the contrary will require more rigorous planning measures if operational gaps could hamper an evacuation. Thus, sub-categories derived from those proposed in point 3.1.1 can be developed to direct this vast identification and enumeration phase. For example, residential areas can be defined and classified according to building density -- low, average or high. Business areas can be subdivided into more specific categories depending on the surfaces they occupy -- street-level retail business, shopping centres, wholesalers, large-scale warehouses, etc.).

3.1.3 IDENTIFYING AND CHARACTERIZING EXISTING RISKS IN EACH CITY AND DISTRICT (OR PLANNING SECTOR)

This sub-stage assumes that, apart from the characteristics of each component in the planning sectors, it is also necessary to measure and evaluate the risks associated with them. For each type of function or activity, indeed each component in each category (buildings, properties, businesses), the **inherent risks** likely to cause a disaster and require the evacuation of the inhabitants must be identified. The same is true of the **risks of failure** -- the underlying logistical problems an evacuation will pose once the decision to evacuate has been made. In each sector, overall evacuation planning should include a careful and complete examination of all the risks presented by each component. The specific features of these risks and their location should be noted so that they can be controlled in time. This will make it easier to locate the source of a disaster and to focus on the most effective safety measures.

The last sub-stage forms part of the second planning stage. Once the planning sectors have been identified and characterized and the risks they involve identified and measured, priority must be given to analysing and planning for the sectors that are considered to be at high risk.

3.2 IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL

While planning efforts with respect to sectors with a low or very weak probability of disaster should not be neglected, particular attention should obviously be paid to those that present

more risks or where the probability of the occurrence of a risk is highest. In the second stage, planners must look more closely at the areas of the city or agglomeration that the first stage has identified as being at high or very high risk.

3.2.1 EVALUATION OF FACILITATING FACTORS AND LIMITING FACTORS IN THE SECTORS, FOR EACH RISK IDENTIFIED

Once the risks have been identified, it must be seen whether the sector that would suffer should the risk materialize can handle it, deal with it or, better yet, mitigate its impact and neutralize the effects. The first sub-stage of what might be called an analysis of the vulnerability of a sector consists in evaluating what elements could help minimize the disadvantages that might occur should the risk materialize (facilitating factors) and, conversely, what elements could accentuate the impact of a risk's materializing and even compromise an evacuation operation in the sector (limiting factors). Whether they are facilitating or limiting, identification of these factors make it possible to assess the general performance level to be anticipated in a sector struck by a disaster in the event an evacuation has to be hastily organized.

3.2.2 STUDY AND EVALUATION OF MITIGATION MEASURES FOR EACH RISK IDENTIFIED

While the facilitating factors constitute positive forces to be used at the time of an evacuation, the limiting factors can cancel out, at least in part, the positive elements that have been identified in the disaster area. For maximum functioning of the sectors in emergency and evacuation situations, part of the planning must be devoted to the analysis and evaluation of response measures that can mitigate, or even neutralize, the negative impacts of the limiting factors. At the same time, such an approach will limit the number of scenarios that could be employed to achieve public safety.

DECISION-MAKING PHASE

3.3 SCRIPTING/SIMULATION/ANALYSIS OF THE STRICKEN AREA(S) AND THE RISK THAT PRODUCED THE DISASTER

At this stage, as shown in Table 1, managers who embark upon the third phase of the model will be dealing with a disaster, either declared or imminent. The seriousness of the situation will require that they reach a decision to ensure public safety. The third stage consists, then, in formulating hypotheses about how the risk in a given sector, imminent or already materialized, will progress. After they structure information on the environment and contexts in which an evacuation might take place, the managers must also find out how the risks will occur and evolve in the area they may affect. The precision with which they conduct this

stage will be a decisive factor in identifying possible choices for an emergency response and subsequent evacuation. Without going overboard, planners ideally should implement this stage without waiting for a disaster to be declared. Prior to that time, those in charge of emergency management will already have substantial information with which to assess the situation and establish an overview on the basis of the earlier scripting.

This stage begins with the identification of a risk that has in fact materialized and produced a disaster, and of the sector that is suffering the consequences. Understandably, if the identification and characterization of the components and risks in the planning sectors were meticulously carried out in the initial planning stage (point 3.1) and scripting has been previously completed, those managing the emergency will save an enormous amount of time should a risk materialize that requires a knowledge of its potential behaviour and progress in a given area and time period. Identification of the risk and the sector to which it pertains make it possible to limit the context in which the risk will evolve in accordance with various assumptions (*scripting* sub-stage).

These risk development scenarios, which are necessarily fluid given the variables and parameters used to consider them (physical and spatial characterization of the sector, topography, environment, atmospheric conditions, climate, temperature, etc.), should ideally then be subjected to more thorough examination using a second sub-stage (called *simulation*), if the progress of the situation so allows. During the simulation, the behaviour of the risk is examined in terms of several measurable variables to determine how the risk situation will evolve at various moments in a given context.

Subsequently, the scenarios should be subjected to an *analysis* for an idea of how things will look at various measured intervals (for example, thirty-minute periods). While it is hard to be sure how the situation will evolve, the scripting sub-stage will make it possible to get a better description of the context in which a disturbance might take place and to target with more accuracy and timeliness the actions that will have to be undertaken subsequently.

3.4 DEVELOPING EMERGENCY RESPONSE SCENARIOS FOR THE DISASTER AND FOR SECONDARY RISKS AND EFFECTS EITHER PRESENT OR ANTICIPATED (EVALUATING OPTIONS)

Once the consequences of the disaster have been identified and characterized and their impact has been determined on the sector(s) they affect, consideration must be given to what emergency response will be effective should an evacuation prove necessary. Once knowledge has been obtained of the sectors and the hazardous risks they present in the case of a disaster, it is time to consider what emergency response scenarios can realistically be implemented. It should be noted in this regard that there is no scientific procedure or

selection method for achieving this. Normally, if the analysis and evaluation stage has been well done and if the planners have been motivated by a desire for thoroughness, the limitations noted in the inventories and subsequent analyses would have to point with sufficient accuracy to a list of potential response scenarios.

Certainly, it is clear that, once a disaster occurs, those responsible for managing it will have very little time to carry out this stage. Nonetheless, it should be completed regardless of the lack of time. This may make it possible to avoid later delays in the process, caused by inappropriate actions requiring that the situation be re-analyzed in depth or a solution adopted that could turn out to be ill-advised.

3.5 DETERMINING THE BEST RESPONSE SCENARIO ACCORDING TO THE NATURE OF THE DISASTER AND OF PRESENT OR ANTICIPATED SECONDARY RISKS (EVALUATING OPTIONS)

This stage marks the preparatory phase for making the actual decision or recommendation to evacuate. Now that all the response scenarios have been listed in terms of the disaster's probable evolution, it will be necessary to determine the optimum response scenario that should be implemented in the affected sector. It should be remembered that this part of the model must be adapted to the context of the disaster at hand. The approach is obviously not the same, depending on whether the disaster has struck, is imminent or is merely anticipated. Special attention must be given to imminent disasters, taking into account the fact that the evolution of the situation is more uncertain in such cases and will require more meticulous follow-up than where the disaster has already happened and its consequences are already observable.

To determine the optimum scenario in the circumstances, five sub-stages are proposed:

3.5.1 STUDY OF POSSIBLE EVACUATION RESPONSE SCENARIOS

The first sub-stage requires a study of possible scenarios for a risk that has materialized. All forms of response consistent with the progress of the situation should be listed. No possibility should be excluded at the outset, including no response whatsoever ("do nothing"), which may sometimes be better than over-hasty action.

3.5.2 ANALYSIS OF ACTUAL SECONDARY RISKS AND THEIR EVOLUTION OVER TIME

The second sub-stage requires analysing the risks or secondary effects actually observed when the disaster occurs (arising from the main risk). This analysis of the consequences of the disaster will help limit the number of possible response scenarios. As a result of observing the secondary effects and their evolution over time, some scenarios will show

themselves to be non-operational or inadequate in the context. Accordingly, this task should be carefully carried out, because the results of that analysis will guide the choice of what option to take more easily and quickly.

3.5.3 CHOICE OF THE BEST RESPONSE SCENARIO

Once an overview of all the risks has been determined, a response scenario is chosen. Although there is no pre-established formula for selecting the best scenario, since the variables and factors that can play a role are manifold and transient, one main principle should guide the manager's choice: a scenario should be chosen that optimizes resources (both in personnel and time), that keeps costs as low as possible -- without losing sight of the fact that people's lives are priceless, and that what must be done to save lives should be part of the minimum costs -- and, finally, that limits risks, whether already materialized or imminent, both for evacuees and responders.

3.5.4 STUDY OF MITIGATION MEASURES FOR SECONDARY RISKS IN THE DISASTER

In terms of this scenario, the fourth sub-stage requires a study of the mitigation measures for secondary effects. It is very unlikely that even the best scenario will avoid all the secondary risks caused by the disaster. The strategy of ensuring people's safety, especially if it involves their evacuation, is very likely to pose certain problems when implemented. It follows that it is necessary to establish what effects of the disaster could perturb the evolution of the scenario, in terms of what was noted in point 3.5.2 and, for each secondary effect, what means are available to neutralize or eliminate them, so that the public safety is ensured in accordance with the scenario. As in the case of the response alternatives established in point 3.5.1, it is preferable that no mitigation measure be excluded out of hand.

3.5.5 PROPOSAL FOR MITIGATION MEASURES APPROPRIATE FOR THE CHOSEN SCENARIO

At the end of the fifth stage, it must be determined what mitigation measures, among those noted earlier, should be integrated into the chosen response scenario. Here again, there is no pre-established formula to determine what the best measures are. The context in which the disaster takes place and its multiple variables will allow determination of what measures are desirable and realistic to put in place. It should be remembered that, all things being equal, the less expensive measures should have priority and, conversely, where costs are equal, the most effective measure should be considered.

3.6 MAKING THE DECISION OR RECOMMENDATION

Lastly, the planning and preparation of the decision will end when the final recommendation is transmitted to the decision-maker for a scenario safeguarding the public (evacuate; isolate;

isolate and evacuate afterward; following what procedure). After this sixth stage, the decision-making phase ends. It is now time to act in dictating what the final choice will be, the one that the manager(s) have chosen as the best strategy for safeguarding the public in accordance with the circumstances observed.

RESPONSE PHASE

3.7 DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION

In the seventh stage, the decision regarding the disaster in progress is disseminated and put into action. This requires two sub-stages:

3.7.1 DISSEMINATION OF THE DECISION INTERNALLY AND EXTERNALLY

This sub-stage will consist in informing people within the decision-making structure (those managing the emergency) and outside it (the other responders), the public at large and the media of the substance of the operational strategy and the stages planned.

3.7.2 ESTABLISHMENT OF LOGISTICAL MEASURES TO SUPPORT EVACUATION OPERATIONS

After the decision has been disseminated, the schedule for operationalization is implemented. The decision then officially becomes action to respond to the events. This schedule, it almost goes without saying, requires putting adequate logistical measures in place for the application of whatever strategy has been chosen (coordination centre, complete telecommunications and computer systems, functional and comfortable facilities, etc.).

3.8 FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY

Once the evacuation strategy has been launched, the managers must immediately follow up on it and carefully observe how the strategy is progressing in the light of the initial response plan and the way the risk is evolving at various times in the analysis. More specifically, even if it has been decided that the public should be evacuated according to a specific procedure, the circumstances surrounding the disaster are going to continue to evolve. As a result, an in view of the high degree of uncertainty that characterizes the scripting, it is essential that the managers continually bring additional information to the decision-making process and inform themselves on how their chosen evacuation strategy is being implemented in the field. Subsequently, the managers must make a general evaluation of the strategy that they

have decided on. This will involve measuring how well the strategy is working. Are things happening as expected? Are the needs evaluated adequately met? Did the script work out as anticipated? Are difficulties being encountered that had not been anticipated? and so on. The comment at the end of point 3.4 is valid here: even if this stage has to be completed in haste, because the required amount of time is not always available, it should nevertheless be carried out adequately, or the result may be a failure as needless as it is undesirable.

3.9 REVISITING THE DECISION OR RECOMMENDATION

As the situation in the field unfolds, the decision-makers will have to take steps to eliminate the mistakes, deficiencies -- primarily in resources --, inadequacies and other irregularities that might occur during the implementation of the evacuation strategy. The initial decision must be re-evaluated and lead to secondary decisions, flowing from the initial process, in order to correct problems encountered as a result of mistaken expectations or the unexpected evolution of the circumstances. Equally, these secondary decisions will keep open the possibility of reaching the objectives determined by the managers at the outset.

In broad strokes, this model suggests the steps that should be followed in order to plan an evacuation operation in a consistent and useful manner. The next chapter will explain the tasks that must be completed depending on the responder to which they pertain.

CHAPTER 4: THE TASKS INVOLVED IN MAKING A DECISION TO EVACUATE

This chapter describes what the chief municipal and metropolitan responders must do, at a minimum, to plan for making the best decision in respect of an evacuation. It should be noted that the tasks listed in this chapter are described in generic terms for the municipal departments and, more generally, the public administrative activities usually involved in developing a strategic evacuation plan. In view of the appreciable differences in urban and metropolitan departmental structures, each city or metropolitan administration must adapt the task descriptions in this chapter to its own circumstances. Similarly, the tasks presented here by department or by function are only indications and some of them could just as well be performed by a number of other departments. The tasks suggested here should generally be considered as guidelines to be later adapted to the reader's own situation. The Appendix reproduces an overview of the evacuation planning proposed in this Guide. The reader who wishes to get a general picture of the process is invited to refer to it. The remainder of this chapter presents the municipal and metropolitan officials who are most likely to have to respond in an evacuation operation. It also discusses some provincial ministries and agencies that should be included in planning by the municipality or metropolitan administration because of the crucial tasks they will have to perform in the event of an evacuation.

4.1 TASKS FOR WHICH MUNICIPAL OR METROPOLITAN DEPARTMENTS ARE RESPONSIBLE

4.1.1 CHOOSING AN EMERGENCY MEASURES DIRECTOR OR MUNICIPAL OFFICIAL

The city council, which is concerned with ensuring public safety effectively and in all circumstances, has an interest in determining who will be **responsible for co-ordinating activities and responders in an emergency situation**, which includes a potential evacuation. The importance of rigorously and clearly establishing the roles of those who will be called on to act in the event of a disaster cannot be over-emphasized. It begins with making a determination, at the municipal level -- and at the top of the pyramid -- about **who decides, who co-ordinates and who plans**. The choice of a director responsible for the organization of municipal emergency measures and thus the planning of potential evacuation operations is a step in the process that cannot be avoided. If there is uncertainty about who is in charge, or if this person's role is poorly defined, the actions of other municipal or metropolitan responders, as the case may be, could result in serious defects in the emergency planning measures or evacuation and even cause problems in the on-site response if a disaster is declared.

It is therefore up to the municipality to decide who will be responsible for planning emergency measures and evacuations. It could be the city manager or the chief of the fire department, to whom, incidentally, this task has often been assigned in the past. (**It is not recommended, however, that the fire chief be asked to act as emergency measures director**. Given the responsibility such a mandate entails, it is preferable to chose an emergency measures co-ordinator from another department or function). Regardless of who is chosen to perform these tasks, it is essential to define his mandate with precision.

According to the stages in the model presented in Chapter 3, this person will have to complete the following general tasks:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying all planning sectors in the system at risk and all potential emergency responders, by planning sector:

The director or co-ordinator should in principle be responsible for dividing up the area affected by the system at risk (the city or agglomeration, as the case may be) for the purpose of evacuation planning. The co-ordinator can obviously entrust this task to another department, such as city or regional planning. This must, however, be done at the outset so that the planning process gets off to a good start. This will ensure that the potential responders are all operating within the same frame of reference.

The director must next inventory all municipal, metropolitan, governmental and community responders whose assistance he intends to request in the event of an evacuation in the municipal or metropolitan area for which he is responsible. After the responders have been identified, the director should develop a evacuation response agreement with each player. This will set out their roles and responsibilities in the event of an evacuation. It would also be a good idea for the co-ordinator to consult them on points requiring clarification vis-à-vis the tasks that must be anticipated and performed to cover the various aspects of evacuation planning and avoid overlooking any possible responder in the event of an evacuation.

At the very least, the municipal emergency measures co-ordinator who is responsible for ensuring strategic planning for an evacuation should obtain the collaboration of responders to work on the following task groups or activity areas:

- Security: - police;

- firefighters/fire department;
- Health: - medical care;
- public health;
- Environment;
- Transportation: - ambulances;
- public transit;
- traffic;
- City/regional planning;
- Communications;
- Services to evacuees.

Clearly, evacuation planning conceived and designed to give a particular sector the time and the resources to organize itself adequately must incorporate the above elements. The co-ordinator in charge should therefore enter into agreements with the appropriate municipal departments and agencies for particular functions during an evacuation operation, integrating the various responders into the overall planning process as much as possible. The agreements should specify the responsibilities of each department, the resources it will provide and the particular kind of response that it will be asked to provide.

2 - Identifying and characterizing response components in the task groupings, by planning sector:
In this second sub-stage, the emergency measures co-ordinator must become acquainted with all the measures and plans that the responders who have been assigned to work in a specific task area during a potential evacuation intend to employ. As it will be up to him to supervise the overall evacuation operation, it is essential that he know how and where each player will act.

3 - Identifying and characterizing existing risks in each city and district (or planning sector):
For this sub-stage, and for the rest of the planning stage, the co-ordinator should perhaps seek the agreement of the responders as to what the areas or planning sectors and the risks are. Agreement on such matters makes response procedures more effective. "Brainstorming" is a good approach for the various responders to use to reach such agreement.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:
While it is not up to the emergency measures co-ordinator to survey

facilitating factors and limiting factors or to list possible mitigation measures, he should seek the consensus of municipal responders on the recognition and identification of sectors with a high disaster potential. At this stage the risk-generators should be included in the analytical process through consultation and repeated exchanges between the co-ordinator and the other responders, in order to devise "plans of attack" in the event of an evacuation. This should lead to integrating the various methods for managing a disaster and evacuation.

To bring the responders closer together for the next stage, the co-ordinator could also order or organize simulations, seminars and training workshops. This approach would be useful in further specifying which sectors are at high risk of disaster and how the various players can respond properly.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:

The co-ordinator activates the emergency plans and/or evacuation plans according to the procedures that have been established beforehand. He co-ordinates the overall response of all the players. He may, and even should, reach an agreement with the provincial ministry responsible for public security concerning whatever assistance and support the ministry can provide to the municipality in a disaster.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:

The co-ordinator supervises the formulation of possible response scenarios depending on the nature of the disaster and the risks that arise from the situation. Meetings with the heads of each department or the responders involved will be necessary to evaluate the accuracy of the various assumptions that have been made.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

The co-ordinator will do the same as in the preceding stage. To that end, he will have to establish a group analysis procedure calling on various responders and proposing the following tasks:

1 - Study of possible evacuation response scenarios: if an evacuation is required, what can be done to evacuate the public, what are the possible evacuation scenarios and how can they be carried out;

2 - Analysis of actual secondary risks and their evolution over time: has the disaster caused risks or secondary effects that make the scenarios

enumerated under number 1 inoperative?;

3 - Choice of the best response scenario: of the remaining scenarios, which have the greatest likelihood of success and of becoming operational?;

4 - Study of mitigation measures for secondary risks in the disaster: taking into account the secondary risks in the best response scenario, what measures can be implemented to reduce or eliminate the incidence of secondary risks?;

5 - Proposal for mitigation measures appropriate for the chosen scenario: what practicable mitigation measures are capable of being effectively incorporated in the chosen strategy?.

The municipal emergency measures co-ordinator, depending on the procedure he intends to follow, would benefit from knowing what response and expertise resources are available, and from consulting them when the time comes.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

Depending on how the emergency evacuation plans assign responsibility for making the decision, the co-ordinator can make the decision himself or he can co-ordinate a group process leading to the choice of a response.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The co-ordinator must ensure that the decision regarding the response scenario is adequately disseminated and understood by all the responders affected by the decision. He must also implement the warning plan designed to ensure that all responders are informed of the strategy that is to be implemented, and see to it that the plan is implemented as anticipated with all the resources required (human, logistical and material). He must also activate the public communications plan and check with the people in charge of communications that this plan is being properly implemented.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The co-ordinator must ensure that the decision on the response scenario is correctly applied by all responders concerned. He must also check with them on the state of the situation and assess the way the strategy is working and the performance of the workers in the field.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

Depending on how the strategy is being implemented in the field and the problems encountered by the responders in organizing the evacuation, the co-ordinator must re-evaluate the situation with the decision-maker(s) or councillor(s) -- depending on the decision-making structure in place -- and transmit any changes in the initial decision in a timely manner to the responders concerned.

The work of the emergency measures or public safety co-ordinator is of vital importance because he must supervise the whole planning stage and, later, management of the emergency and evacuation measures. His role is therefore essential to ensure that all the players converge on a single action strategy. Nonetheless, each department or player asked to participate in the planning stage will have to continue to supervise the specific tasks that relate to his own field of responsibilities. The remainder of the chapter resumes the discussion of some of the players presented in chapter 2 and analyses their respective planning tasks in greater detail.

4.1.2 CITY/REGIONAL PLANNING DEPARTMENT

The municipal or metropolitan planning department (depending on the level of planning) must in the context of emergency or evacuation operations provide emergency managers with all information relating to urban and regional resources, whether physical or human. Depending on the stage in the process, the planning department's role may tend to be overshadowed. In an urban context, however, the contribution of this department to planning for a massive evacuation is crucial in all the initial stages of the process, in order to formulate as complete a description as possible of the context in which the evacuation will take place:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

The municipal or metropolitan area must be subdivided into planning sectors, which the planning department can do (unless decided otherwise) given the type of information and data it handles. Each sector must be subjected to a detailed and exhaustive characterization, so that decision-makers can be provided with information as soon as it is required. The characterization must therefore follow these stages:

1 - Identifying each sub-system in the agglomeration (cities or districts/planning sectors):

In each defined planning sector, it is necessary to identify:

a) **residential** areas, whether low, medium or high density. Data on the

socio-economic profile of the residents and how they are distributed over the area in terms of residential occupancy must also be included (including a breakdown of residents by time of day or night, day of the week, or weekend and seasonal demographic fluctuations due to tourism);

b) **office** areas, whether low, medium or high density. Locating the high-density concentrations normally found in downtown areas is crucial in this connection;

c) **commercial** areas: complementing residential or administrative activities, they are generally found in linear concentrations (streets with businesses at street level) or in special built-up areas (shopping centres). This category should also include hotels and most activities of a recreational and tourist nature. Special attention should be paid to commercial spaces occupied by service stations and gas pumps as risk areas;

d) **institutional** areas: these include all public facilities serving community life: schools, churches and other places of worship, hospitals, penitentiaries and detention centres, community service centres, theatres, libraries, arenas, sports and cultural centres and so on;

e) **public spaces**: public parks, city squares, regional nature reserves and cycling paths are generally considered in this category;

f) **public easement networks**: the identification and location of right-of-ways for telephone, electricity, natural gas, drinking water and even cable systems can control certain risks or determine access routes during an evacuation;

g) **industrial** areas: given the nature of the activities in such areas and the handling of materials presenting major risks for an environmental catastrophe, these areas should be the subject of detailed study and data gathering. It is also important to distinguish among the various industrial areas by type of activity (traditional vs. high tech; light vs. heavy). Port and airport areas should also be considered risk areas;

h) **road network** and **public access routes**: presented by type (local, collector, ring roads, highways, etc.), this is of vital importance in planning the evacuation of a large number of people from a big city. Railways still in operation should be included;

i) **spaces left over, vacant or no longer in use**: vacant or unoccupied spaces that do not have or no longer have a particular use, as well as parking lots, landfill sites and squats must also be inventoried, if only because of the risks they may represent. Conversely, depending on the circumstances, these properties should be inventoried in terms of the protection they can provide for people without shelter (in an extreme, last-resort case, and on a strictly temporary basis).

2 - Identifying and characterizing the components of each city and district (or planning sector):

The characteristics of each resource identified in each category in point 1, for each planning sector, must be identified. Included in the characteristics that should be noted are, in respect of buildings and lots, the physical dimensions (area, volume, height, density of occupation, number of people present during the day or at night, reception capacity (for relocation areas)); in respect of traffic lanes, their physical and statistical characteristics are of prime importance (length, width, number of lanes, average volume and maximum possible traffic volume, etc.). For data characterizing the population, the usual socio-economic variables should be included: language, ethnic origin, religion, age, sex, household size, income of individuals and households, education, profession, number of cars per household, number of televisions and radios, population density in space and time (daytime population vs. nighttime population), breakdown of the population by area or district according to the variables used, number of people employed in areas of activity requiring the employment of a qualified labour force, etc.

3 - Identifying and characterizing existing risks in each city and district (or planning sector):

Identification of the risks followed by their characterization will proceed in the same manner as for point 2. Special attention must of course be paid to the industrial sectors, easement networks (high tension lines, gas lines etc.), the road network, railway or maritime corridors, airport areas and abandoned or poorly monitored areas.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

After the area is divided into planning sectors, those with a high disaster potential must be identified where the consequences for the life, health or safety of the public or the environment could be serious, perhaps fatal. It is even advisable, once the physical and demographic components have been determined, to establish what parts of areas or sectors are particularly likely to suffer a disaster and to what extent a risk in such areas may be mitigated by facilitating factors or accentuated by limiting factors. Since determination of the risks is not the direct responsibility of the city planning department, this will have to be done by the department responsible for environmental matters. The city planning department can, however, contribute the information it has generated in stage 1.

1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:

The study and evaluation of facilitating factors and limiting factors in each sector with a high disaster potential requires the city planning department to note and make a general analysis of the following:

a) Facilitating factors:

- existing and available **emergency resources** in the disaster area and neighbouring sectors capable of an immediate response (police, firefighters, ambulances, health, volunteer agencies, etc.) or of evacuating residents;
- **communications and warning measures** available in the disaster area and neighbouring sectors for announcing an evacuation (police, firefighters, radio station, ham radio network, etc.);
- **urban infrastructures and easements** that can mitigate the threat and thereby limit the number of people to be evacuated: shelters, fire hydrants, water supply and sewer networks, etc.;
- **certain characteristics or equipment** (in terms of protection against disasters: fire prevention equipment, basic emergency response equipment, etc.): such characteristics could, on some occasions, reduce the size of a disaster and, by extension, the number of people to be evacuated.

b) Limiting factors:

- **building dimensions**: height, width, depth, shape, placement, etc.. These elements may act as limiting factors for certain risks; they may also slow down or complicate an evacuation (e.g.: the placement of tall buildings may offer protection from certain risks, but also create air currents that could accelerate the dissipation of toxic fumes);
- **building characteristics:** number and placement of doors and windows, possible views from windows, placement and serviceability of stairways, existence and level of service of elevators, escalators, smoke-barrier doors, building type (concrete, steel, wood, etc.), and so on. These elements -- which may often be useful -- can also act as limitation factors on handling the risk and may even on occasion increase the danger when the time comes to evacuate a portion of the population. They may act as a brake on an evacuation movement that has begun;
- **some urban infrastructures and easements**: electricity and natural gas networks can amplify the consequences of a risk and complicate an evacuation operation in some circumstances.

2 - Study and evaluation of mitigation measures for each risk identified:

The questions that must be asked, in terms of what has been determined in

the preceding point, are as follows:
- What can be done to maximize the effect of the facilitating factors when a disaster strikes (e.g.: take advantage of a well-identified period of good traffic flow along certain routes to launch an evacuation, take advantage of the depopulation of a residential area at certain times of the day to begin an evacuation during the day)?
- What can be done to minimize the effects of limiting factors when a disaster strikes (e.g.: in winter, if people are already indoors, can they be kept there and temporarily isolated, can the height or width of a building be used to advantage to limit the spread of the risk? Can the limitations be turned to the advantage of the emergency operation or evacuation)?
- Can the risks caused by the disaster be predicted: where, when, how, how long and how much? What actions can be taken to limit the effects of the risks?
- Can the consequences of the disaster be limited in the short run? How can the consequences be overcome or substantially reduced?

Mitigation measures that the city planning department can anticipate to limit the risks of disasters and resulting evacuations include:
(i) strict regulation of construction in or near areas recognized as having high disaster potential;
(ii) detailed planning for urban development that integrates response measures for disaster situations and emergency measures for planning sectors that have a high disaster potential (this should apply to individual city planning projects as well);
(iii) development of infrastructures and infrastructure elements to ensure protection for the surrounding environment (protective screens, buffer zones, safety fences, etc.) to limit the extent of the risks related to the occurrence of a disaster or evacuation.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:

This stage assumes that the risk has actually materialized and the disaster is official. The city or regional planning department during this stage must do the following:

*1 - **Determine where** (in what sector or planning area) the risk has materialized;*

*2 - **List and cross-reference urban, environmental and demographic components** of the stricken area(s);*

3 - At the request of the director of public security or the emergency measures co-ordinator, ***determine the consequences*** *of the materialized risk for the urban components of the stricken area* (where the population is located, how it is distributed, where it is concentrated, where it will go, what perimeters should be evacuated and in what order, what roads should normally be used for the evacuation, etc.);

4 - At the request of the director of public security or the emergency measures co-ordinator, and given the consequences and behaviour of the disaster, ***prepare scenarios for how the situation might evolve*** *from a city planning perspective:* for example, one could anticipate population fluctuations (in numbers of people) in the sector hit by the disaster at various times during the response, or anticipate the movements of the public in a downtown area hit by a disaster at various times during the day, etc.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:

In this stage, the city planning department or whatever agency is responsible for regional planning has no specific task to perform.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

The city planning department -- or whatever agency is responsible for regional planning -- has no specific task to perform during this stage. It may continue to provide information to those in charge of the emergency measures, depending on the needs expressed by the latter.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The city planning department -- or whatever agency is responsible for regional planning -- is not involved at this stage. However, while those in charge choose a strategy for ensuring public safety, the department should continue to gather information and data so that it may inform the decision-makers, if need arises.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The city planning department -- or whatever agency is responsible for regional planning -- will have to follow up on the information it has and communicate new information and any changes in the situation as they occur.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN

RESPONSE STRATEGY:

The city planning department -- or whatever agency is responsible for regional planning -- will have to follow up on the information it has.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

During the final stage of the process, the city planning department -- or whatever agency is responsible for regional planning -- will have to follow up on the information it has.

4.1.3 THE LOCAL POLICE FORCE

Generally speaking, the municipal or metropolitan police force must protect the inhabitants and supervise the security perimeter that has been determined for the emergency operation, whether or not evacuation is involved. More specifically, in terms of evacuation planning, the tasks of the police force will be as follows:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying police security resources and components in the system at risk (city or agglomeration, as the case may be):

A survey of all the equipment and facilities possessed and in use by the police should be made, broken down by planning sector: vehicles, buildings, instruments and arms, safety and protective equipment, etc.

2 - Identifying and characterizing police force components:

The components listed under point 1 will then have to be characterized and defined. In connection with this task, it is desirable to present a breakdown of resources (human and material) in the municipal or metropolitan area, depending on police districts or stations and police schedules in order to establish what resources are available for an evacuation when required. The breakdown and location of resources should preferably be done in co-ordination with the sectoral planning carried out by the municipal emergency measures co-ordinator. A suitable service agreement should be entered into with the provincial police force concerning tasks and responsibilities in the event of an evacuation.

3 - Identifying and characterizing risks in each planning sector that may affect the work of the police force:

This will involve, on the basis of the information covered under point 2, determining where the police force will have the most problems in

responding and where its level of performance may be reduced as the result of risks detected in one or more of the affected sectors (e.g.: identifying a police station situated in an area where an earthquake is highly probable, or next to an area of heavy industry, etc.).

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

The local police force, in conjunction with other departments, must be able to identify the planning sectors it anticipates will require more resources or more elaborate planning because of a higher probability of disaster. This analysis should take into account factors raised by the other responders, to ensure that all players agree on which sectors require such planning. In this context, once the sectors with the greatest disaster potential have been identified by the group of officials, the police force will have to go through the two sub-stages presented in the model in Chapter 3:

1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:

In each of the planning sectors, the police force must survey the facilitating factors and the limiting factors:

Facilitating factors:

- **human and material resources** available to the police force to carry out an emergency or evacuation operation with success;
- **resources in terms of time** available for the police to warn the public and organize an anticipated evacuation;
- **human and material resources available from another police force** near the sector or city affected by the disaster;
- **time of year** (e.g.: spring or summer), **time of day** (e.g.: early evening) and **time of the week** (e.g.: weekend) when a disaster is declared: these can make a great difference in the work of the police in an evacuation operation.

Limiting factors:

- **anticipated road-use conflicts** with other emergency services (firefighters, ambulances, public transportation, etc.);
- **lack or inadequacy of safety equipment**, preventing police from responding or restricting their work in or near a disaster area;
- **human limitations of the personnel when the response effort lasts too long**: absenteeism; stress or panic experienced by officers; abandonment of posts during the emergency or evacuation, inability to find competent

personnel quickly for specific tasks, or, conversely, a surplus of qualified persons or volunteers, etc.

2 - Study and evaluation of mitigation measures for each risk identified:
The questions to be asked, in terms of what has been determined in the preceding point and taking into account the consequences resulting from each of the risks apprehended, are as follows:
- What can be done to maximize the effects of the facilitating factors when a disaster strikes (e.g.: in extreme emergencies, establish whether police vehicles can be used to evacuate certain people; take advantage of a well-identified period of good traffic flow along certain routes to launch an evacuation; take advantage of the depopulation of a residential sector at certain times of the day to begin the evacuation)?
- What can be done to minimize the effects of limiting factors when a disaster strikes (e.g.: in winter, if the public is already indoors, can they be kept there and temporarily isolated? Can special traffic lanes be provided for police vehicles)?
- Can the risks caused by the disaster be predicted: where, when, how, how long and how much? If so, certain resources can be directed towards areas where a disaster is feared and safety activities undertaken, including evacuation.
- Can the consequences of the disaster be limited in the very short term? How can these consequences be eliminated or substantially reduced (e.g.: for the human resources, can shifts be planned that allow officers to recover physically and psychologically?)

Mitigation measures that the police force can provide to limit disaster risks and resulting evacuations include:
(i) a patrol schedule specifically designed for sectors with a high disaster potential so that any emerging problem can be detected as quickly as possible;
(ii) establishment of emergency traffic signals and communications between the police force and risk generators in sectors with a high disaster potential to activate rescue or warning operations;
(iii) public information sessions before a disaster ever happens, to explain the basic steps local residents should take to limit interference with police activity.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:
In this stage, the police force should do the following:

*1 - **Determine where** (in what sector or planning area) the risk has materialized;*

*2 - **List and cross-reference urban, environmental and demographic components** of the stricken area(s);*

*3 - At the request of the director of public security or the emergency measures co-ordinator, **determine the consequences** of the materialized risk on its components and resources in and around the sector affected;*

*4 - At the request of the director of public security or the emergency measures co-ordinator, and given the consequences and behaviour of the disaster, **prepare scenarios for how the situation might evolve** from a logistical perspective (how to ensure public safety, how to alert the public, what perimeters should be evacuated and in what order, what roads will be used for the evacuation, how traffic should be directed along the arteries, etc.):*

More specifically, this involves determining in what ways the situation could change. All possible outcomes should be identified, taking into account existing circumstances and conditions (what risks have materialized, their characteristics and the situation in the disaster area);

*5 - At the request of the director of public security or the emergency measures co-ordinator, **the police force can participate in the simulation of how the situation might evolve** (dynamic evaluation of the scenarios):*

Using simulation software, and on the basis of the evaluation of consequences carried out under the preceding point, the focus will be on learning, in terms of the changing values assigned to the parameters of the variables, the possible evolution of each scenario that has been envisaged so that the situation can be followed as closely as possible. Then, by taking into account the demographic and urban characteristics of the affected area, as well as available police resources and how they can be deployed, officials will be in a better position to determine the appropriate protective strategy;

*6 - **Analysis of the sectors affected and the risk that has materialized**:*

Quite often the risk will be moving (spills, toxic plumes and fumes, etc.) and will affect more than one planning sector. The results of the simulations should be analyzed and an evaluation made of how the situation in the sectors, and the risk, will evolve, and the probability that a particular phenomenon will occur appears highest. The local police force may be asked to take part in analysing the sectors affected by the disaster and

determining the preliminary resources required to conduct an eventual evacuation scenario.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:

Once the most plausible situations have been listed and described, the police force must list its response options. By response is meant the steps and tasks that the police force is able to carry out given the facilitating factors that assist it and the human and material resources available to it. The police force must be able to indicate, based on the most logical projections, its emergency response capability for the response scenarios that are the most likely to be implemented. Following this, the information must be communicated to the managers (starting with the co-ordinator in charge) so that the future scope of the police response in a potential evacuation can be assessed.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

The police force is not involved during this stage. Nevertheless, it may be asked to take part in the recommendation process leading to a choice of response. In this case, the police, and others, will do the following:

1 - Study of possible evacuation response scenarios: if an evacuation is required, what can be done to evacuate the public, what possible scenarios are there and what means are available for carrying them out?;

2 - Analysis of actual secondary risks and their evolution over time: did the disaster result in risks or secondary impacts rendering the scenarios listed under point 1 inoperative?;

3 - Choice of the best response scenario: of the remaining and most relevant scenarios, which has the best chances for success and is most likely to be put into operation, taking the consequences of the disaster into account?;

4 - Study of mitigation measures for secondary risks in the disaster: considering the secondary risks inherent in implementing the best scenario, what measures could be put in place to reduce or eliminate their impact?;

5 - Proposal for mitigation measures appropriate for the chosen scenario: which mitigation measures are truly practicable and can be effectively incorporated into the chosen strategy?

The police must continue to inform emergency measures directors as they request it.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The police force is not involved during this stage. It may however be asked to explain its activities or make recommendations to guide the decision-makers in their ultimate decision. The police will continue to inform emergency measures directors as they request it.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The police force may be asked to disseminate the decision or recommendation to evacuate. Subsequently, they will have to direct the evacuation, according to the emergency plans, by directing traffic and conducting surveillance in the perimeter evacuated. Their participation during that stage will also involve informing managers of the turn of events and how the evacuation procedure is being implemented or the strategy executed.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The police force will continue, during this stage, to inform those in charge of the emergency measures of how the evacuation is proceeding so that they can evaluate the appropriateness of their decision.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

The police force may be asked to keep decision-makers informed about the situation or to formulate recommendations with a view to modifying the original decision.

4.1.4 THE FIRE DEPARTMENT

In operations involving an evacuation, the planning conducted by the fire department could be guided by the following:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying the resources of the fire department and its components in the system at risk (city or agglomeration, as the case may be):

As with the police force, the fire department must survey all equipment and facilities under its control, broken down by planning sector: vehicles, buildings, devices, safety and protective equipment, etc.

2 - Identifying and characterizing fire department components:
Here again the components under point 1 should be described and documented as much as possible. The distribution of resources in the municipal or regional area by district or fire station (human and material resources) is of great importance in planning any emergency operation or possible evacuation.

3 - Identifying and characterizing risks in each planning sector that could affect the work of the fire department:
On the basis of the characterization of the information covered under point 2, the fire department should determine the sectors where its effectiveness could be decreased and its performance affected by breakdowns caused by the disaster (e.g.: ruptures in water mains making it impossible to fight minor fires in a disaster area; partial damage to a firehall located in a sector shaken by violent quakes, etc.).

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:
The fire department, in conjunction with other departments, must be able to identify the planning sectors in the city that have a high disaster potential and where the response will require more facilities or more detailed planning. This analysis should take into account factors raised by the other responders, to ensure that all players agree on which sectors require such planning. Once the sectors with the highest disaster potential have been identified, the fire department, like the other departments, will have to address the following two sub-stages:

1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:
In each planning sector with high disaster potential, the fire department must survey facilitating factors and limiting factors. This will make it easier to develop more effective plans in terms of the risks identified. Such factors include:

Facilitating factors:
- **human and material resources** available to the fire department for conducting an emergency operation or evacuation with success;
- **resources in terms of time** available to the fire department for rescuing victims, warning the public and undertaking a partial evacuation;
- **human and material resources available from another fire**

department near the sector or city affected by the disaster;
- **time of year** (e.g.: spring or summer), **time of day** (e.g.: early evening) or **time of the week** (e.g.: the weekend): these can make a great deal of difference to the firefighters' emergency response and evacuation work;
- **height of buildings and ground-level occupation density** (e.g.: in the case of an explosion or toxic fumes, a residential area of single family houses, low in height and separate from each other, may be evacuated more easily than an area of skyscrapers or apartment buildings).

Limiting factors:
- **anticipated conflicts in using road and traffic arteries** with other emergency services (police, ambulances, etc.);
- **lack or inadequacy of safety equipment**, preventing the firefighters from responding or restricting their activities in or near the disaster area;
- **human limitations of the personnel when the response effort lasts too long:** absenteeism in emergencies; stress or panic among personnel; abandonment of posts during the emergency or evacuation; inability to find competent personnel quickly for specific tasks, or, conversely, a surplus of qualified people; etc.;
- **nature of the disaster** itself: some toxic spills, for example, may decrease or eliminate the effectiveness of firefighters' work or seriously limit their activities;
- **presence of hazardous materials in an area with a high disaster potential**: such materials, regardless of their properties, may restrict the activities of the fire department.

2 - Study and evaluation of mitigation measures for each risk identified:
The questions to be asked, in terms of what has been determined under the previous point, are as follows:
- What can be done to maximize the effects of the facilitating factors when a disaster strikes (e.g.: take advantage of a well-defined period of good traffic flow along certain routes to launch an evacuation; take advantage of the depopulation of a residential sector at certain times of the day to begin the evacuation)?
- What can be done to minimize the effects of limiting factors when a disaster strikes (e.g.: in winter, if the public is already indoors, can they be kept there and temporarily isolated? Can special traffic lanes be provided for fire trucks)?
- Can the secondary risks caused by a diaster be predicted: where, when, how, how long and how much? If so, certain resources can be directed towards areas where a disaster is feared and measures taken to ensure public

safety;
- Can the consequences of the disaster be limited in the very short term? How can these consequences be eliminated or substantially reduced (e.g.: for human resources, can work shifts be planned that will allow the firefighters to recover physically and psychologically? If a situation involves a major fire, can a perimeter be marked out and the risks arising from the disaster isolated, thereby reducing the work of ensuring public safety outside the perimeter?)?

Mitigation measures that the fire department can provide for disaster risks and resulting evacuations include:
(i) planning and putting in place response measures and safety devices on the front line for the fire department in sectors with a high disaster potential (for example, the department may reach an agreement with risk generators regarding the installation of response facilities specifically adapted to its response needs in these areas);
(ii) a joint inspection program with risk-generating installations to update emergency or evacuation plans and allow the fire department to become more familiar with those installations in the event of an evacuation;
(iii) establishment of emergency signals and communications between the fire department and risk-generating points in sectors with a high disaster potential to activate rescue or warning operations;
(iv) public information sessions before a disaster ever happens, to explain basic steps local residents should take to limit interference with the activities of the firefighters.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:
The fire department, in this stage, should do the following:

*1 - **Determine where** (in what sector or planning area) the risk has materialized;*

*2 - **List and cross-reference the components** of the stricken area(s);*

*3 - At the request of the director of public security or the emergency measures co-ordinator, **determine the consequences** of the materialized risks on the components of the system or area affected;*

4 - At the request of the director of public security or the emergency measures co-ordinator, and given the consequences and behaviour of the

disaster, ***prepare scenarios for how the situation might evolve*** *from a logistical perspective (how to limit the disaster, how to ensure public safety, how to alert the public, what perimeters or buildings should be evacuated, in what order and according to what plans, etc.):*

More specifically, this involves determining in what ways the situation could change. All possible outcomes should be listed, taking into account existing circumstances and conditions (the risks that have materialized, their characteristics and the nature of the disaster area);

5 - At the request of the director of public security or the emergency measures co-ordinator, ***the fire department may be invited to take part in the simulation of how the situation might evolve*** *(dynamic evaluation of the scenarios):*

Simulation software will help ascertain, in terms of the changing values assigned to the parameters of the variables, the possible evolution of each scenario so that the situation can be followed as closely as possible. Then, by taking into account the demographic and urban characteristics of the affected area, as well as the resources available to the department, officials will be in a better position to determine an appropriate protection strategy and what response preparations should be made;

6 - ***Analysis of the sectors affected and the risk that has materialized****:*

Especially where the risk is moving (spills, toxic plumes and fumes, etc.) and will affect more than one planning sector, the fire department should analyze the sectors affected. After that, consideration should be given to the results of the simulations and how the situation in the sectors, and the risk, will evolve, and the probability that a particular phenomenon will occur appears highest.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:

Once the most likely situations have been listed and described, the fire department must list possible response options. The response includes the steps and tasks that this department can undertake with the assistance of the facilitating factors and available human and material resources. The fire department will have to indicate, on the basis of the most logical projections, its response capability for the response scenarios that are the most likely to be activated. The information must then be communicated to the managers (starting with the co-ordinator in charge) so that the scope of the firefighters' response in a potential evacuation can be evaluated.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING

OPTIONS):

Although this is not one of its responsibilities, the fire department may be asked to take part by recommending a response. If so, this department, like the others, will implement the following procedure:

1 - Study of possible evacuation response scenarios: if an evacuation is required, what can be done to evacuate the public, what are the possible evacuation scenarios and what means are available for carrying them out;

2 - Analysis of actual secondary risks and their evolution over time: did the disaster result in risks or secondary impacts rendering the scenarios listed under point 2 inoperative?;

3 - Choice of the best response scenario: which of the remaining scenarios has the best chances for success and is most likely to be put in operation?;

4 - Study of mitigation measures for secondary risks in the disaster: considering the secondary risks inherent in implementing the best scenario, what measures could be put in place to reduce or eliminate their impact?;

5 - Proposal for mitigation measures appropriate for the chosen scenario: what mitigation measures can be realistically be incorporated into the chosen strategy?

The department will also provide information to emergency measures officials as they request it.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The fire department may be asked to make recommendations to assist the decision-makers in their ultimate choice of an evacuation scenario. The fire chief, depending on the emergency plans, can also be designated to make the decision. The department will continue to provide information to those in charge of the emergency measures as they request it.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The fire department may be asked to disseminate information regarding the evacuation decision or recommendation and to intervene in the rescue operation or the evacuation. However, its participation at this stage will mainly consist in informing managers of the turn of events and how the evacuation procedure is being implemented.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The fire department will continue, during this stage, to inform those in charge of emergency measures of how the evacuation is proceeding so that they can evaluate the appropriateness of their decision. In view of the important role played by firefighters during an emergency or evacuation operation, the fire department will, at this stage, be a key source of information.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

The fire department may be asked to inform the decision-makers about the situation or to formulate recommendations with a view to modifying the original decision. Depending on the emergency plan, the chief may also be asked to make a new decision if he has decision-making authority.

4.1.5 THE TRAFFIC FUNCTION

The primary mandate of the department with responsibility for managing traffic in the municipality or metropolitan structure will be to plan how and along what arteries a mass exodus would take place in an evacuation using the existing road network and taking its advantages and limitations into account. The tasks it must perform are:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying the components of the road network:

In conjunction with the departments responsible for city planning and public transportation and with the provincial transportation ministry, the traffic department will have to identify and map the agglomeration's road network and specify its components (location, length and width of rights-of-way, etc.). This information should be compiled jointly by the four departments, or shared with the others, for the sake of consistency and uniformity. In addition, if this information is followed up on by the departments involved, it will avoid conflicts in interpretation and location and, possibly, planning errors;

2 - Identifying and characterizing components of the road system, by planning sector:

It should compile data on arteries in the network: number of local arterial roads, collectors, regional or metropolitan highways, other highways, location, placement of rights-of-way, statistics on the level of performance

of each artery (useful life and level of maintenance, level of deterioration, quality of paving and other physical and technical details, load-bearing capacity and level of service, both estimated and observed, etc.). More specifically, it is important to identify and locate intersections and exchangers, interfaces with other means of transport (train, planes, etc.), limited access corridors and funnels causing traffic jams and congestion that slow traffic and affect traffic flow in the network;

3 - Identifying and characterizing the risks along or crossing the road network:

Using data from the city planning department, the public transportation department and the provincial ministry of transportation, the traffic department will have to identify the segments of the road network that present a risk of disaster (transportation of hazardous materials, in particular) as well as the segments of the network that might skirt risks generated in the agglomeration or alternatively be paralysed or seriously perturbed by these risks.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

In conjunction with the city planning department, the public transportation department and the provincial transportation ministry, the municipal traffic department should establish what segments or areas of the municipal or metropolitan road network are particularly vulnerable in the event of a disaster and to what extent a disaster in these segments could be mitigated by facilitating factors or accentuated by limiting factors.

1 - Evaluation of facilitating factors and limiting factors vis-à-vis arterial roads in each sector, for each risk identified:

To study and evaluate facilitating factors and limiting factors of the points at risk along the road network, the traffic department must survey and analyze the following elements (this stage may be completed, in part, with the provincial ministry of transportation):

a) Facilitating factors:

- **identification of traffic lanes with good traffic flow, smoothly functioning interfaces and fast traffic points** in normal situations;
- **immediate alternatives for traffic** (which arterial roads can easily be modified to serve as an evacuation route if the routes originally chosen are not completely usable).

b) Limiting factors:

- **condition of arterial roads** (potholes, cracks, crevices, obstacles, other cavities and signs of damage): these may help lessen the serviceability of certain arteries and cause accidents and breakdowns, etc.;
- **physical obstacles to the movement of persons** (bridges, viaducts, interchanges, etc.): they can substantially impede a general evacuation movement;
- **areas of conflicting use or disturbances in traffic flow in the disaster sector** resulting from the simultaneous use of certain arteries by priority emergency vehicles (police, firefighters, ambulances, etc.) coming into the area while private vehicles of evacuees are trying to leave the area;
- **buildings and their dimensions** (height, width, depth, shape, placement, density, etc.) and the number of people in them at the time of the disaster; these can quickly become bottlenecks if the evacuation must be carried out in great hurry;
- **urban functions along certain arteries**: if certain sectors must be evacuated rapidly, heavily populated residential areas, or densely populated commercial strips or areas of heavy pedestrian traffic, may cause traffic slowdowns and increase the risk of road accidents;
- **weather conditions** and their influence on road conditions: such conditions may contribute to decreasing the level of service on certain roads or increase the risk of accidents or cause problems for emergency vehicles trying to serve the disaster area.

2 - Study and evaluation of mitigation measures for risks to the road network:

The questions to be asked, in terms of what has been determined under the previous point, are the following:
- What can be done to maximize the effects of the facilitating factors where a risk has been identified?
- What can be done to minimize the effects of the limiting factors where a risk has been identified? Can they be avoided altogether?
- Can the risks be predicted? How can their occurrence be prevented?
- Can the consequences of the risks be limited in the very short term? How can these consequences be eliminated or substantially reduced to limit the need for an emergency response and, if possible, evacuation operation?

Mitigation measures that the traffic department can provide for may include:
(i) strict regulation of traffic along certain arterial roads for emergency purposes (changing traffic direction, providing reserved lanes for priority vehicles, etc.);

(ii) a carefully planned urban road network in order to avoid conflicts in road use that might cause a disaster or resulting risk, especially when an evacuation operation is implemented;
(iii) strictly enforced special traffic and transport regulations in sectors with a high disaster potential (hours for the transport of hazardous materials, limited access for certain categories of vehicles, etc.).

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:

The department responsible for traffic, in this stage, must perform the following tasks (this stage may also be carried out with the participation of the provincial transportation ministry, using information generated earlier by the ministry):

*1 - **Determine where** (in what part of the municipal or metropolitan road system) the risk producing the disaster has materialized;*

*2 - **List and cross-reference the components** of the affected road network;*

*3 - **Determine the consequences** of the materialized risk on the components of the road network and traffic flow (both for emergency vehicles to pass through the sector and for evacuees' vehicles to leave the sector);*

*4 - In terms of the consequences and behaviour of the risk, **prepare scenarios for how the situation might evolve and how the public might later be moved**:*

Based on the information procured by health and environment specialists, it must be determined how the situation could change. This means listing all the things that could occur in the disaster area given existing road conditions (traffic flow and level of service of the road network) and the consequences they would have on the performance of the roads if they are used to evacuate the public;

*5 - **Simulate how the situation might evolve** (dynamic evaluation of scenarios):*

Simulation software will help ascertain, in terms of the changing values assigned to the parameters of the variables (level of service, flow, load-bearing capability, etc.), the fluctuations in each of the evacuation scenarios, so that the situation can be followed as closely as possible and so that the most appropriate protection strategy can be worked out, taking into account the demographic, physical and urban planning characteristics of the affected area;

*6 - **Analysis of the systems and the risk**:*
The results of the simulations should be analyzed and an evaluation should be made of the performance of the road traffic network, how the risk will evolve and the probability that a particular situation will occur. This process should be repeated as often as the basic data are modified by new information.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:
During this stage, the traffic department should be able to give decision-makers as detailed and thorough a portrait as possible of the traffic situation in the area affected by the disaster: what characteristics and components of the road network are the most affected or threatened, which are still functioning, what limitations exist and the estimated number of people in the disaster area, so that the consequences for the level of service of the roads may be evaluated. Depending on the nature of the risk and its characteristics, the department will have to determine, on the basis of its data, what operational scenarios are possible to ensure public safety. It must establish the conditions for implementing an evacuation based on the spatial characteristics of the affected area.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):
Although this is not part of the traffic department's mandate, it may be asked to help determine the best scenario to ensure public safety. In this stage, this department and others will implement, to a greater or lesser extent, the following procedure:

1 - Study of possible evacuation response scenarios from the perspective of traffic and traffic flow;

2 - Analysis of actual secondary risks and their evolution over time;

3 - Choice of the best response scenario;

4 - Study of mitigation measures for secondary risks in the disaster;

5 - Proposal for mitigation measures appropriate for the chosen scenario.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:
The department responsible for traffic does not intervene at this stage.

However, while the decision-makers select a strategy to ensure public safety, the traffic department must continue to gather information and data so that it can inform the decision-makers if necessary regarding the level of service to be expected from the arteries identified and chosen for the evacuation.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The department responsible for traffic must follow up on the information it has and communicate new information and changes as they occur.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The department responsible for traffic must follow up on the information it has and communicate new information and changes as they occur.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

Depending on how the public safety operation proceeds in the disaster area, the department responsible for traffic will have to follow up on the information it has and propose alternative measures in the event the original strategy proves inadequate.

4.1.6 THE DEPARTMENT RESPONSIBLE FOR PUBLIC TRANSIT AND OTHER TRANSPORTATION SERVICES

The public transit department -- or the corresponding metropolitan agency -- will have a key role to play in ensuring transportation for a large number of people should the decision be made to proceed with an evacuation. Given that a fairly high percentage of urban dwellers do not have motor vehicles, public transit is often the only way they have to leave the city or agglomeration. Private transporters (taxi and bus companies) could be called on to back up public transit if the evacuation takes on major proportions. Accordingly, planning by these services for a potential transportation operation is of some significance:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying the components of the transportation systems, by planning sector:

a) Identification of all existing public transit systems:

- bus routes;
- subway routes;

- commuter trains;
- adapted transportation services (disabled persons, people with limited mobility, school buses, etc.).

b) Identification of private transportation systems:
- taxi companies;
- private bus companies with regional or national routes;
- school bus companies;
- private railway companies with regional or national routes (for mass evacuations or evacuations in remote areas);
- air lines (for mass evacuations or evacuations areas).

2 - Identifying and characterizing the components of each system:
For each system, whether public or private, it is important to document the information by identifying, for each route, the number of vehicles available, the number of seats per vehicle, the estimated and observed level of service (depending on the time, day or season), the number of people that each vehicle can take per trip, the maximum load capacity (if additional people are allowed on the vehicle, for example), the estimated frequency of trips of the vehicles along a route (length of cycle), the dispersion capacity, the regroupment capacity, the personnel assigned or available, fuel reserves available and their potential for use in an evacuation, etc.

3 - Identifying and characterizing the risks that may be encountered by the transportation systems (public and private):
With data from the city planning department and the traffic department and, if appropriate, from the provincial transportation ministry, the public transit department must identify the segments of the network or the routes that may encounter risks generated in the agglomeration. It is important to identify and locate these risk areas carefully so that, depending on the nature of the disaster and the risks causing it, the public transit department can better plan its subsequent emergency response if an evacuation is implemented.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:
In conjunction with the city planning department and the traffic department, the department or company responsible for public transit must establish which parts or areas of the municipal or metropolitan road system are particularly vulnerable in the event of a disaster (this would, logically, be done by planning sector). In addition, it must establish the extent to which the public transportation network and equipment may be affected if a risk

materializes throughout the agglomeration and, more specifically, in the planning sectors with high disaster potential. The department will have to determine how the risks under consideration can be mitigated by facilitating factors or accentuated by limiting factors, especially where an evacuation is carried out.

1 - Evaluation of facilitating factors and limiting factors vis-à-vis public transit routes in each sector, for each risk identified:

The study and evaluation of facilitating factors and limiting factors affecting the most sensitive points along the public transit network involves surveying and analyzing the following elements:

a) Facilitating factors:

- **public transit resources available to respond immediately** in the disaster area;
- **prior identification of bus lanes**: this includes not only existing lanes but also roads that could temporarily serve as bus routes during an evacuation;
- **existence of alternative solutions for ensuring movement of public transit vehicles**: for example, could a vacant lot or a large unused area be used for public transit vehicles in the event road arteries were jammed during an evacuation?

b) Limiting factors:

- **emergency resources available in the disaster area** (police, firefighters, ambulances, etc.): depending on their activities in the perimeter to be secured, these resources may conflict with the activities of public transit vehicles removing evacuees from the area;
- **arterial road conditions** (potholes, cracks, crevices, obstacles, craters and signs of damage): they may decrease the level of service provided by public transit vehicles along certain arteries;
- **urban infrastructures and easements** relied on to mitigate the threat: shelters, hydrants, water and sewer systems, etc.: if these infrastructures are affected by a disaster, that could necessitate changes on certain routes or worse, could hinder vehicular traffic;
- **weather conditions** and their influence on conditions along arterial roads: such conditions may decrease the level of service of certain public transit vehicles along certain arteries;
- **buildings and their dimensions** (height, width, depth, shape, placement, density, etc.): the buildings may, depending on the number of people in them at the time of the disaster, contribute to creating traffic jams and funnels for public transit vehicles if the evacuation has to be carried out in

great haste;

- **urban functions along certain arteries**: if certain sectors have to be quickly evacuated, functions such as residential areas with a sizeable population or commercial strips with heavy pedestrian traffic can reduce the level of service on certain routes (congestion, slowdowns, accidents, etc.).

2 - Study and evaluation of mitigation measures for risks to transportation networks (publicly and privately owned):

The questions to be asked, based on what has been determined under the previous point, are as follows:

- What can be done to maximize the effects of the facilitating factors where a risk has been identified?
- What can be done to minimize the effects of limiting factors where a risk has been identified? How can conflicts be avoided between public transit vehicles and other priority vehicles (police, firefighters, ambulances, etc) in the use of traffic arteries?
- Can the risks be predicted? How can their occurrence be prevented?
- Can the consequences of the risk be limited in the very short term? How can these consequences be eliminated or substantially reduced to maximize the performance of public transit in an evacuation?

Mitigation measures that the public transit system may provide for include:
(i) participating in putting into place a general traffic control by-law along certain arteries for public transit in emergencies (changes in traffic direction, reserved lanes, special boarding areas, etc);
(ii) detailed planning as to how the public transit network and emergency infrastructures in the urban area will activate the evacuation procedure when this becomes urgent, i.e., by planning special circuits, calling on supplementary or special vehicles for assistance (e.g.: taxis, trucks, trains, helicopters, etc.).

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:

During this stage, the public transit department must:

*1 - **Determine where** (what part of the network) the risk has materialized;*

*2 - **List and cross-reference the components** of the affected transportation networks;*

*3 - **Determine the consequences** of the materialized risk on the components of the affected transportation networks:*

This means establishing how the materialized risk affects the level of service throughout the system (routes blocked or diverted, overloading both apprehended and actual, increased need for transportation in certain places, etc.);

4 - In terms of the consequences generated by the disaster and the behaviour of whatever risk has materialized, ***prepare scenarios for how the situation could evolve and how the public could be moved****:*
This involves determining how the situation could develop, which means listing hypotheses about what could happen, taking into account the circumstances observed and the actual conditions of the public transit network (flow and level of service through the network and its components). The role and the place of the routes and vehicles available will then have to be re-evaluated if they are to serve for evacuating the public;

5 - ***Simulate how the situation might evolve*** *(dynamic evaluation of scenarios):*
Simulation software will help ascertain, in terms of the changing values assigned to the parameters of the variables (levels of service on each route in each system, availability of vehicles, availability and performance of personnel, etc.), the possible fluctuations in each evacuation scenario, so that the situation can be followed as closely as possible and, taking into account the demographic and city planning characteristics of the affected area, so that the most appropriate strategy can be established for moving public transit vehicles (private and public);

6 - ***Analysis of the disaster area and the materialized risk****:*
The results of the simulations should be analyzed and an evaluation made of how the situation will evolve in the disaster area, primarily in terms of the behaviour of the risk that has materialized. In that way, the planners will be in a better position to guide the development of scenarios likely to improve performance by public transit networks. This process must be repeated as often as the basic data is modified by new information.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:
In this stage, the public transit department should be able to give decision-makers a specific and detailed picture of the situation in the area affected by the risk, in terms of the movement of public vehicles (bus, trolleys, streetcars, subways, etc.), the characteristics and components of the system that are the most affected or threatened, the parts of the system that are still

operating, the limitations, the estimated number of people in the affected area, whether public transit vehicles could evacuate the disabled, etc. Depending on the information received, the public transit department will have to determine the best scenarios for transportation of the public and identify the various conditions for implementing the evacuation in terms of the spatial characteristics of the affected area and the public transit resources available for this purpose. Depending on the chosen scenario, implementation should include such features as modified routes, deployment of special routes, projected levels of service for each circuit, identification of existing and anticipated lanes, plans for other categories of vehicles (taxis, trucks, school buses, etc.), personnel to be mobilized, etc.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

Although not specifically a part of its mandate, the public transit department may be asked to participate in determining the best scenario for ensuring public safety. In this stage, this department and the others will by and large have to implement the following procedure:

1 - Study of possible evacuation response scenarios assuming the possible evacuation of the population by public transit;

2 - Analysis of actual secondary risks and their evolution over time;

3 - Choice of the best response scenario;

4 - Study of mitigation measures for secondary risks in the disaster;

5 - Proposal for mitigation measures appropriate for the chosen scenario.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The public transit department does not take part in the decision-making. However, when the decision-makers reach a decision on the strategy that is to be implemented for ensuring public safety, the transportation department should continue to gather information and data so that it can keep the decision-makers informed, should this be necessary.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The department will have to follow up on the information it has and communicate new information and changes as they occur. It will also have

to ensure liaison with all the private transportation networks that have been asked to take part in the response.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The department will have to follow up on the information it has and communicate any changes as they occur.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

Depending on how the work of ensuring public safety in the disaster area proceeds, the public transit department will have to follow up on the information it has, communicate new information and changes as they occur and propose new solutions where the original strategy proves inadequate.

4.1.7 THE AMBULANCE SERVICES

Although the nature of their work in an emergency operation precludes extensive participation in a mass evacuation, ambulance services may be asked to help in the evacuation of people with special needs at the time of the evacuation (clinics, hospitals, reception centres, etc.). When that happens, the local ambulance services must be ready to act. Their tasks in the planning process will be more or less as follows:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying existing ambulance systems (private and public):

In the first sub-stage, both public and private services available in the area must be identified. Doing this at the outset also makes it possible to assess the level of transportation service that can be provided by ambulances in the various planning sectors.

2 - Identifying and characterizing the components of the ambulance services in each planning sector:

For each sector, ambulance resources must be scrupulously and carefully characterized: number of vehicles, human resources assigned and available, identification of service points, vehicle locations, level of performance by area or sector, speed of response to emergencies, maximum capacity for transporting people by vehicle, etc.

3 - Identifying and characterizing the risks encountered by ambulance services, in each planning sector:

Using the urban data gathered by the city planning or public transit

departments, ambulance services will have to identify the portions of their network or routes that might pass near risks generated in various sectors of the city or agglomeration.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

The ambulance services, in conjunction with the other services, must identify those planning sectors in the city with high disaster potential, where their response may require more measures or more detailed planning. This analysis should be carried out in conjunction with the other responders, to ensure that alls players agree on which sectors require such planning.

1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:

In each planning sector with high disaster potential, the ambulance services must survey the facilitating factors and limiting factors so that they can plan more effective action to deal with the risks identified:

Facilitating factors:

- **human and material resources** available to ambulance services for evacuating the disabled;
- **human and material resources available from other ambulance services** near the sector of the city or agglomeration affected by the disaster.

Limiting factors:

- **anticipated conflicts in sharing the use of traffic arteries** with other emergency services (police, firefighters, public transportation, etc.);
- **condition of road arteries** (potholes, cracks, crevices, obstacles, marks and signs of damage): can reduce the level of ambulance service along certain arteries;
- **lack or inadequacy of safety equipment**, preventing ambulances from responding or restricting their effectiveness in or near the disaster area;
- **human limitations of the personnel when the response effort lasts too long**: absenteeism in emergencies; stress or panic among personnel, abandonment of posts during the emergency or evacuation; inability to find competent personnel quickly for specific tasks, or, conversely, a surplus of qualified people; etc..

2 - Study and evaluation of mitigation measures for each risk identified.

The questions to be asked, based on what has been determined under the previous point, are as follows:

- What can be done to maximize the effects of the facilitating factors when a disaster strikes (e.g.: take advantage of a well-identified period of good traffic flow along certain routes to launch an evacuation, take advantage of the depopulation of a residential area at certain times of day to launch an evacuation)?
- What can be done to minimize the effects of the limiting factors when a disaster strikes (e.g.: can existing equipment be used effectively despite its inadequacies? Are there alternative means or strategies? Can volunteers be used to back up regular personnel? Can special traffic lanes be earmarked for ambulances?)?
- Can the risks caused by the disaster be predicted: where, when, how, how long and how much? If so, some resources can be directed to where it is feared the disaster will strike and the appropriate responses can be undertaken (possibly limiting the extent of an evacuation);
- Can the effects of the disaster be reduced in the very short term? How can the consequences be eliminated or substantially reduced (e.g.: can shifts be planned for the workers so they can recover physically and psychologically)?

Mitigation measures that could be provided for by the ambulance services to limit problems in transporting disabled people during evacuations include:
(i) setting up emergency signals and communications between the ambulance services and their main service points (clinics, hospitals, reception centres, senior citizen's residences, etc.) to activate rescue or warning operations in sectors with high disaster potential;
(ii) public information sessions, before a disaster ever happens, to explain basic steps local residents should take to limit interference that might cause delays in ambulance operations.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:
During this stage, the ambulance services must:

*1 - **Determine where** (what part of the network) the risk has materialized;*

*2 - **List and cross-reference the components** of the ambulance services affected:*
This primarily involves seeing whether the ambulance services will be compromised and restricted in their later evacuation activities. It could be useful to make a preliminary identification of the basic resources (human and material) that will have to be deployed or that will, at a minimum, be

required for a later evacuation operation.

*3 - **Determine the consequences of the disaster and** of the materialized risk for the components of the ambulance service network:*
In other words, it must be established how the disaster and the materialization of the risk that produced it affect the level of ambulance services (routes blocked or diverted; overload, apprehended or actual, in some sectors; increased ambulance transport needs in some locations, etc.);

*4 - In terms of the consequences generated by the disaster and the behaviour of whatever risk has materialized, **prepare scenarios for how the situation may evolve and how the evacuation of those people requiring ambulance transport will be effected**:*
It must be determined how the situation could change and what adjustments the ambulance services might have to make to adapt to fluctuations in the situation and the resulting needs for ambulance transportation. A list of the situations that could arise must be drawn up, taking into account the circumstances of the disaster and the restrictions it imposes on the level of ambulance service in the disaster area. At the same time, such projections in the form of scenarios will help with determining how an evacuation should be planned and what role the ambulance services will play;

*5 - **Simulate how the situation might evolve** (dynamic evaluation of the scenarios):*
Simulation software will help ascertain, in terms of the changing values assigned to the parameters of the variables (level of performance, speed in conducting transport operations, traffic flow along ambulance routes, endurance of the staff, etc.), the changes that each evacuation scenario might have to undergo. This will make it possible to follow the situation as closely as possible and to establish, on the basis of the demographic, physical and city planning characteristics of the affected area, the most appropriate evacuation strategy for the ambulances (in terms of routes, number of vehicles used, ability to transport more than one person, etc.);

*6 - **Analysis of systems and the risk**:*
The results of the simulations must be analyzed and an evaluation made of how the performance of the ambulance services (level of service, capacity, resources that can be mobilized, etc.) and the behaviour of the risk will evolve, and what situation seems most likely to occur. This process should be repeated as often as new information alters the basic data.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:

In this stage, the ambulance services must be able to determine as specifically as possible on behalf of the decision-makers what the situation is in the area affected by the disaster in terms of the movement of ambulances, the characteristics and components that are the most affected or threatened, which ones are still operational (vehicles and routes), what constraints exist (lack of qualified personnel, lack of first aid equipment, etc.), an estimate of the number of people in the affected area who will have to be evacuated by ambulance (taking into account the presence of special care institutions: clinics, hospitals, reception centres, etc.). Depending on the nature of the risk th has materialized, its characteristics and consequences, the ambulance services will have to determine, on the basis of their information, the best operational scenarios for transporting people by ambulance. They must establish the various conditions for implementing the evacuation, taking into account the spatial and road characteristics of the area.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

The ambulance services may be consulted during the phase in which the best safety scenario is determined. In this stage, the ambulance services and others will, by and large, implement the following procedure:

1 - Study of possible evacuation response scenarios, taking into account resources available to be assigned to ambulance transport;

2 - Analysis of actual secondary risks and their evolution over time: it is extremely important, in view of the special nature of the problems of ambulance transport, to establish how these risks may affect the level of service that can be provided by ambulance transport;

3 - Choice of the best response scenario;

4 - Study of mitigation measures for secondary risks in the disaster;

5 - Proposal for mitigation measures appropriate for the chosen scenario.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The ambulance services does not participate directly in this phase of the process. However, while the decision-makers decide on a strategy to ensure public safety, the ambulance services should continue to gather information

and data so they can inform the decision-makers if need be of any changes that might be required to serve the disaster area.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:
The ambulance services will have to follow up on the information they have and communicate new information and changes observed as they occur.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:
The ambulance services will have to follow up on the information they have and communicate new information and changes as they occur.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:
Depending on how the work of ensuring public safety in the disaster area proceeds, the ambulance services will have to follow up on the information they have, communicate new information and changes as they occur and propose changes to the initial strategy for ambulance transport if it proves inadequate.

4.1.8 THE RECREATION/COMMUNITY DEVELOPMENT DEPARTMENT AND PLANNING SERVICES FOR DISASTER VICTIMS

Readers may find it somewhat surprising that a function as important as planning services for disaster victims should be assigned to such municipal departments as the recreation department or the department responsible for community affairs. However, this makes sense in so far as services for disaster victims are only an outgrowth of the mandate of that municipal function whose usual task is managing community life. The writers do not claim that this solution must be followed to the letter. Again, it must be remembered that the choice of a particular department for a particular function must be adapted to individual circumstances. However, on the face of it, the municipal departments that are closest to the daily life of the community and therefore the most likely to respond in an emergency to the needs of residents are the departments of recreation, social services or community affairs. That is why, in any event, general evacuation planning should turn over all matters relating to disaster victims to one of these departments.

Few cities have the means to maintain a department specifically devoted to managing disasters or protecting victims of disasters. The municipal department(s) that will have to supervise this aspect of evacuation planning will have to base their approach on identifying outside resources that can respond for that purpose. In this context, unlike the other municipal or metropolitan departments, the mandate to plan services for disaster victims will

mainly consist of identifying and, to an even greater extent, co-ordinating the responders and their respective activities.

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying all sub-systems in the area (cities or districts/planning sectors):

The responsible department will not directly identify and divide up the territory for which planning is required. However, at this stage in the planning process, the department concerned should familiarize itself with the breakdown of the territory, the planning sectors and their general characteristics. This will later make it possible to determine needs by planning sector through juxtaposing the characteristics of the sectors and the on-site, available resources that can be assigned to providing services to disaster victims.

2 - Identifying and characterizing responders in terms of the services they can provide to disaster victims and their respective components:

This is the crucial task for the department responsible for planning services for victims. The activities and purpose of this part of the process are centred here. The available response resources able to provide a full range of services to disaster victims must be clearly identified. This stage thus comprises three basic tasks:

(i) Identifying the services that will be required for disaster victims: experience has shown that "services for victims" usually involve five kinds of responses to aid persons in distress:

- **Registration and information**: as a general rule, this means collecting basic information about the evacuees, finding out what they need and where they are and searching for evacuees at the request of their family or friends;
- **Shelter**: providing temporary shelter for evacuees;
- **Food**: providing food and meals for evacuees;
- **Clothing**: providing clothes for evacuees, particularly where they have no resources and no protection against the elements;
- **General services**: this mainly consists of ensuring support for evacuees (basic medical care to prevent injuries from getting worse or to save lives; moral support to those who are suffering).

It is therefore up to the municipal or metropolitan department responsible

for planning such services to see that response resources are ready to be activated when an evacuation is ordered.

(ii) Identifying response resources: This involves making a list of players who could be involved in providing services for disaster victims. The list must include such resources as:

- **volunteer organizations directly involved in carrying out emergency measures and humanitarian activities**: the Red Cross is the primary and often the only resource, the Salvation Army (depending on the resources it has available at the local level), St. John's Ambulance, etc.;

- **charitable and community groups and movements**: the Salvation Army, Sun Youth, YMCA, YWCA, etc.;

- **social clubs and private associations**: Lions, Kiwanis, Optimists, Daughters of Isabella, Knights of Columbus, etc;

- **specialized agencies, or those with a very specific mandate**: a special place should be given to the Humane Society or Society for the Prevention of Cruelty to Animals (SPCA) for the care and protection of domestic animals[4].

(iii) Characterizing response resources: the department responsible for planning services for victims should then identify the appropriate resources for each kind of service offered. In other words, the resources needed for each of the five kinds of service must be determined along with the category of service in which each of the responders called upon should be asked to act. This involves characterizing each group or association that will be integrated into the overall evacuation planning. This in turn requires knowing:

- its **particular or specific area of expertise**;

- its **other areas of expertise**;

- the **human resources it has**: professional staff, extra staff, volunteers, etc;

- the **material resources available to it**: equipment, materiel, buildings and warehouses, land, transport vehicles, etc.;

- its **usual response procedures**: knowing how a responder does things is of great practical use when it comes time to integrate and co-ordinate activities during an actual evacuation;

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[4] The local role and mandate of the Humane Society or SPCA in this type of operation must be verified. If it cannot take charge of the care and protection of animals in the evacuated sector, the department responsible for planning and implemnting services to victims should take over that responsibiltiy. It is very important to make provision for this kind of care, because the temporary abandonment of pets creates additional stress among evacuees and often explains their refusal to leave their homes.

- the **suppliers or sub-contractors with whom the group or association deals**: suppliers should not be neglected. If complete evacuation procedures are established, suppliers should also be familiar with them to ensure that all of the required resources will be available at the proper time.

It will be important to take pains to identify and characterize the facilities and buildings that will serve as shelters, accommodation centres or registration and information centres so that evacuees can reach them without difficulty. Service agreements should be entered into with each responder to specify the roles, tasks and responsibilities of each in providing services to disaster victims.

3 - Characterizing the risks threatening the response resources (services for disaster victims):

The location of response resources must be pin-pointed according to planning sector. Depending on what the characterization of the urban territory reveals (see the city/regional planning function), it must be determined what risks are likely to impede the work of the response workers in providing services for victims.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

Although the resources that would be involved in providing services to disaster victims do not have to take part in the actual identification and characterization of sectors with high disaster potential, their activity in stage 2 should mainly concentrate on identifying the areas where their response could run into problems. Response workers should inform the person in charge of planning and co-ordinating services for disaster victims of the limiting factors, primarily, the **human limitations of personnel when the response effort lasts too long** (absenteeism in emergencies; stress or panic among personnel; abandonment of posts during the emergency or evacuation; inability to find competent personnel rapidly for specific tasks, or, conversely, a surplus of qualified people; etc.). This could impede later implementation of the public safety strategy.

STAGES 3 TO 6 (INCLUSIVE):

There is no specific task to perform for these stages. However, the department co-ordinating the planning of services for disaster victims will have to ensure that resources are ready, and mobilized when the time comes. It will also have to ensure that logistical information concerning

response workers is properly relayed to the decision-makers, who will obviously need to know what possibilities exist for action in this regard. Such information will mainly be required at the scripting stage and again when the final response scenario is chosen.

Communication of new information to the decision-makers will clearly be up to whoever is in charge of co-ordinating the implementation of services to disaster victims.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The function responsible for co-ordinating services for disaster victims should disseminate the decision to the response workers so they can prepare for providing services to evacuees.

STAGES 8 AND 9 (INCLUSIVE):

The department in charge will ensure follow-up of operations and will keep managers and decision-makers informed regarding anomalies or problems encountered in implementing services to evacuees. At the proper time, it will contact the responders involved in providing services for disaster victims about any changes to the public safety strategy (the decision made in stage 6).

4.2 JOINT PLANNING BY MUNICIPAL DEPARTMENTS AND CERTAIN PROVINCIAL MINISTRIES AND SERVICES

Municipalities will undoubtedly find it useful to plan their overall evacuation operations in close collaboration with responders from higher levels of government. The major players involved in an emergency or evacuation, and the purpose of their response in such situations, were briefly described in chapter 2. To help improve general municipal evacuation planning, this section discusses the planning tasks that should be undertaken by the municipality with the assistance and technical and logistical support of various provincial ministries and agencies. Although each city must determine its own planning priorities and needs in evacuation planning, consideration should be given to four areas of intervention that are usually the responsibility of provincial governments. The municipality could enter into service agreements with their provincial government in these areas. The ministries concerned can also provide the municipality with a significant amount of information of relevance to the final decision.

In view of the importance of these services in evacuation planning and the support they can offer to urban affairs in planning for an emergency situation, municipalities should conduct joint planning sessions with the ministries responsible for social services, health and communications. This does not mean that other ministries do not have a role to play. On the contrary, each municipality should take full advantage of the expertise of the whole range of provincial ministries to improve its planning and increase its capacity to act in an evacuation. It makes particular sense to work with any ministry that handles a specific risk, if it is not already involved, because of the powers and responsibilities given to it by the situation and legislation. However, in terms of strategic planning for an evacuation, priority should be given to the ministries mentioned above, in view of the importance of the information they can provide and the logistical support they can offer in responding to an evacuation in a municipal setting.

It should be remembered that, although provincial and federal departments and ministries are relatively well-equipped in terms of planning and emergency responses and use procedures that are undoubtedly different from the ones proposed in this Guide, the municipality will have to integrate the activities of each ministry into its own planning strategy. Also, it is not up to the provincial ministries to conduct the overall planning or implementation. **It should therefore be remembered that these ministries are response resources, not planning or decision-making resources.**

4.2.1 SOCIAL SERVICES

In planning for an emergency evacuation, a municipality should inventory its own social and community resources to see what assistance could be provided to its residents should an evacuation have to be undertaken. However, if the city cannot already count on such resources, it should make agreements with other players that can provide such responses. Apart from the Red Cross, which can implement front-line services to disaster victims by providing comfort and moral support, provincial social services can co-ordinate a strategy to adapt social services to the needs of a population that has been hit by a disaster. Along these lines, the municipality should, in conjunction with the responsible ministry, plan as follows:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying the social services in the agglomeration:

Identify material and administrative resources by location (central and district administrative centres, community centres, social services centres, hospitals, etc.) and the human and professional resources attached to each centre (psychologists, psychiatrists, psycho-therapists, social workers, community workers, etc.). Volunteer and community resources that can support the professional resources

should also be identified (volunteer organizations, religious communities, etc);

2 - Characterizing the components of available social services, by planning sector (as established by the municipality):
For each component in each planning sector (administration, social services centres, community services centres, etc.), the number of available workers must be specified, the staff classified in terms of their expertise, experience and the various positions to which they can be assigned, and consideration given to how the resources can be allocated in the area during the evacuation and withdrawal period. The social and psychological characteristics of the component should also be specified (does the staff have the physical, mental and psychological strength to cope with an evacuation, has the staff already had to respond in this kind of situation, etc.).

3 - Identifying and characterizing risks in social services:
Inasmuch as personnel management is the main issue when social services are asked to respond, the characterization of risks will, to a large extent, deal with personnel matters, such as absenteeism in an emergency, stress or panic among the personnel, abandonment of posts during the emergency or evacuation; inability to find competent personnel quickly for specific tasks, or, conversely, a surplus of qualified people; etc.

Those services with the highest and lowest levels of performance and effectiveness should also be specified and characterized in anticipation of stage 2.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

Since the reasoning applicable to the other responders is not applicable here (as social services will have to intervene during the relocation stage rather than during the public safety stage), planning by the municipality and social services during this stage will have to anticipate where more services may be required and in what proportions. This information is important for the municipality so that it can determine exactly where to send evacuees at the time of relocation and what services they will be able to count on.

STAGES 3 TO 6 (INCLUSIVE):

The social services have no role in planning the decision. They should however be ready to act at the behest of the municipality and in accordance with the emergency plans. Social services will have to be able to specify what resources they have available at this stage in the process.

STAGES 7 TO 9 (INCLUSIVE):

Social services resources are deployed in accordance with the agreement with the municipality or municipalities and the provisions of the ministry's emergency plan. The municipality will be the principal contractor for planning all required resources in terms of social services and for co-ordinating their activities during the evacuation. It is vital that the roles and responsibilities in the operation be clarified in advance, when the agreements are signed.

4.2.2 HEALTH SERVICES

For the purposes of this discussion, health can be divided into two aspects. The first includes the public health resources that will have to evaluate the situation if a disaster is declared and determine the consequences of the disaster for the health of the public. The second includes all the resources devoted to responses in the health area (hospitals, clinics, etc.).

The municipality, through either its recreation department or the person in charge of emergency measures, has two specific tasks to perform in terms of health. First, it should enter into an agreement with the provincial health ministry concerning the role to be played by the latter in evaluating risks to public health at the time a disaster is declared. The ministry's assessment will make it easier for decision-makers to determine whether a given sector must be evacuated. Second, the municipality should determine what resources it has in the event that a general evacuation requires the evacuation of particular health facilities from the disaster area to other areas. The ambulance services, for example, will certainly play a role in evacuating a hospital located in the middle of a disaster area, but the people evacuated from these centres will have to be relocated and their care will have to be provided for after they are relocated. As was the case for social services, the health services and the municipality doing the planning should agree on common response procedures. The planning should be done as follows:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying the components of the health system:

The provincial health ministry and the municipality should survey all hospital centres, medical clinics, treatment centres, drug treatment centres, psychiatric hospitals, public health protection resources, etc. Their location on a fully detailed map should also be noted.

2 - Characterizing the components of the health system:

The characterization of every resource and facility that is identified must include, in addition to the location and the physical characteristics of the building (number of wings, care units, etc.), a breakdown of users by unit, number of available beds,

average number of users per day, minimum and maximum number, etc. The characterization, as in the case of the social services, must also take into account elements specific to staff and managers. Pharmaceuticals or medical products suppliers must also be identified so their activities may be integrated into the overall evacuation strategy. Finally, an emergency plan should be prepared for the facility. This characterization will have to be done both for the components in the disaster area being evacuated and for the components outside the disaster area that will be receiving evacuees.

3 - Identifying and characterizing the risks in the health system:
In this sub-stage, public health resources will have to assess the overall risks to public health in each planning sector. The location of risks, their sources and consequences must be done with care so that once a disaster is declared, the decision-makers can assess the situation promptly. The information on the risks in each planning sector should be compiled and organized in computerized data banks.

As in the case of social services, the characterization of the risks in health care facilities will be largely devoted to personnel issues, such as absenteeism in an emergency, stress or panic among the personnel; abandonment of posts during an emergency or evacuation; inability to find competent personnel quickly for specific tasks, or, conversely, a surplus of qualified people, etc. The services and facilities with the highest and lowest levels of performance and effectiveness must also be specified and characterized to establish what needs to be corrected to prepare for the possibility of an evacuation.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

As in the case of the social services, planning by the municipality and health services during this stage will have to anticipate where more services may be required and in what proportions. These requirements are important for the municipality so that it can determine exactly where it will send evacuees at the time of relocation and what services they will be able to count on.

Advantage should be taken of the expertise of public health resources, which are already skilled in evaluating risks, to determine more accurately where supervision and response efforts will be needed. The public health resources will be asked, along with other responders, to determine which sectors have a high disaster potential and to define their specific facilitating factors and limiting factors as well as appropriate mitigation measures. This will require consideration of all medical and psycho-social aspects that may be affected by the materialization of a risk (see, among others, the planning variables in point one of chapter 1).

STAGES 3 AND 4 (INCLUSIVE):

Health services have no role in planning the decision. They should however be ready to act at the municipality's behest and in accordance with the emergency plans.

In the case of resources allocated to public health, on the basis of the information produced in sub-stage 3 of stage 1, the municipality must be advised as quickly as possible of the risks and consequences for public health.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):

Public health resources may be asked to take part in evaluating response options for purposes of reaching a final decision. Like the municipal and metropolitan responders and departments that may also be asked to help during this phase, the public health function will have to follow the following process:

1 - Study of possible evacuation response scenarios;

2 - Analysis of actual secondary risks on health and their evolution over time: this sub-stage is obviously the primary task requiring the participation of public health resources;

3 - Choice of the best response scenario;

4 - Study of mitigating measures for the secondary risks in the disaster: here again, the public health resources will have to contribute their information and expertise to determine what steps can be taken to implement the best scenario;

5 - Proposal for mitigation measures appropriate for the chosen scenario.

The public health resources should evaluate the situation and accompanying risks for the entire area to be evacuated and the total population that could be affected (inside and outside the disaster area) and for each component in the disaster area (hospitals, reception centres, treatment centres, specialized residences, etc.) for which public safety measures, such as evacuating the premises, should be considered.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The public health function may be asked to participate in the decision-making process or at least to make recommendations, given the nature of the information it

will evaluate. The parameters of such participation should, however, be clearly set out. It should be noted that, whatever the influence that the public health resources may have on the final decision, this decision must remain the responsibility of the municipal political authorities: either the mayor of the municipality where the disaster occurs or, failing that, the agent or decision-makers formally designated for that purpose by the mayor.

STAGES 7 TO 9 (INCLUSIVE):

The health response resources (hospitals, clinics, etc.) are mobilized in the sectors where they are required according to their agreement with the municipality or municipalities and/or the emergency plan for each building (care centre, hospital, etc.) that must be evacuated. Among other things, hospitals could co-ordinate the activities of personnel assigned to first aid and offer basic medical treatment.

In stage 9, the general health function (the ministry or its agents) will have to provide for and propose alternatives in terms of health protection if the response strategy should prove inadequate.

Special attention must also be given, throughout the response phase (stages 7, 8 and 9), to the deployment of the information resources that are essential for public health. Not only should the municipality establish a public health information strategy with the concerned responders, but it should also ensure that an information program is put in place to inform citizens of what they can do to protect themselves (before, during and after the disaster). The information will be disseminated in accordance with the plans worked out by the communications function. Similarly, studies and tests on drinking water and other public health concerns will have to be conducted in order to reassure the public in general and evacuees in particular.

4.2.3 THE ENVIRONMENT MINISTRY

On a larger scale, the environment ministry is called on to work fairly closely with the municipality in planning, following up and monitoring environmental quality. Its mandate will be to assist emergency managers by providing supplementary information on environmental matters and direct technical assistance through transfer of knowledge and skills to emergency managers. In connection with municipal or metropolitan evacuation planning, the ministry could be asked by a municipality to do the following:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION):

1 - Identifying and characterizing the planning sectors and their environmental components:

Attention must be directed at identifying the characteristics of the city or agglomeration's environment and the possible environmental effects on the planning sectors in the city or agglomeration. For each sector, the following components will have to be surveyed and documented: quality of air and drinking water, climate and atmospheric conditions (temperature, humidity, precipitation, etc.), data on wind direction, sun and presence of various pollutants. Data on wildlife and vegetation in various sectors in each city in the agglomeration should also be included in the survey as much as possible.

2 - Identifying and characterizing the components of each city and district (or planning sector):
More specifically, environmental characteristics must be documented, mapped and broken down by planning sector. Identification of micro-climates, sources of pollution and environmental nuisances is essential information here for the rest of the planning process.

3 - Identifying and characterizing existing risks in each city and district (or planning sector):
For each planning sector in the city in question, some risks will certainly be noted as will potentially hazardous situations resulting from the presence of specific products, activities or conditions. These risks must be characterized and described so that as much as possible may be known about the consequences they could have on the environment, both in the sectors where they are located and in the immediate city, agglomeration or region. The industrial sectors and rail and air transport areas are well known for such problems and require particular analysis. Other elements or factors should also be studied in depth if they are suspected of generating environmental risks.

STAGE 2: IDENTIFICATION AND ANALYSIS OF SECTORS WITH HIGH DISASTER POTENTIAL:

In conjunction with municipal departments and services, the environment ministry should identify the areas considered as being at very high risk for the occurrence of a disaster. This collaborative approach is desirable to ensure uniformity in planning.

Sectors with high disaster potential can be of two kinds and should be located and then analyzed in detail:
(i) sectors where the number of risks that could materialize into a disaster is significant;
(ii) sectors where the number of risks that could materialize into a disaster is low or almost nil, but where, if the risk did result in a disaster, the consequences would be very harmful for the health or safety of people or the environment.

In performing this task, the ministry will have to clarify the following:
- **presence of activities involving hazardous products or materials** (locating risk generators);
- **level of toxicity of products or materials handled, recovered, recycled or discharged**;
- **quantities manipulated, recovered, recycled or discharged** for each material or product;
- **population potentially affected**: the people handling the products and those who could suffer the consequences of a disaster involving a particular product;
- **atmospheric conditions that could act on products and materials** (direction and force of winds, relative humidity, temperature, precipitation, etc.).

Once high-risk sectors have been identified and the risks for each sector have been inventoried and characterized, the environment ministry should advise the municipality on how to analyze the elements that can limit or prevent the risks and what response measures should be taken to ensure public safety. This will facilitate planning for the municipal departments concerned (fire, police, public transit, traffic, public works, etc.) so they may converge, as quickly and effectively as possible, on a common response strategy at the right time. This will be done, in accordance with the process established in chapter 3, in two sub-stages:

1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:
Study and evaluation by the environment ministry of facilitating factors and limiting factors in each sector with high disaster potential involves surveying and analysing the following:

a) Facilitating factors:
- **weather conditions**: wind, humidity, precipitation, temperature, etc. It should be noted that weather conditions must be meticulously noted in terms of the actual risk since in certain cases, they can also be limiting factors;
- **physical and geographical characteristics** of the disaster area: relief, natural obstacles, topography, etc., are factors that can help circumscribe the extent of the risk and its progress. However, they could, in certain circumstances, also act as limiting factors and slow down an evacuation. Assessment of the context will determine whether a facilitating factor or a limiting factor is involved;
- **man-made structures** designed to ensure protection against such risks: identify what constructions already exist in the sector, or even within the disaster perimeter, that could more quickly eliminate the effects of the risk manifested, and which plans or basic measures are already in place to limit damage immediately in the initial

response.

b) Limiting factors:

- characteristics of the bio-physical environment: flora, vegetation, fauna, soil sensitivity, depth of the water table, etc. These features may require careful study and the use of more stringent safety measures, in terms of time and organization, so as not to affect the bio-physical environment. In a number of cases, the manifestation of a risk can work on these factors to aggravate the situation (e.g.: when a contaminant penetrates the water table that supplies a municipality with drinking water, this makes the evacuation that much more difficult);

- prevailing weather conditions at the time of the disaster: they may act as aggravating factors on the disaster situation in certain circumstances.

2 - Study and evaluation of mitigation measures for each risk identified in the planning sectors:

The questions to be asked, based on what has been determined under the previous point, are as follows:

- What can be done to maximize the effects of the facilitating factors when a risk materializes?
- What can be done to minimize the effects of the limiting factors when a risk materializes?
- Can the risks be predicted? How can their occurrence be prevented?
- Can the consequences of the risk be limited in the very short term? How can the consequences be eliminated or substantially reduced?

Mitigation measures that the environment ministry could provide for include:

(i) setting up, with the municipalities concerned, a regular municipal program to inspect facilities and buildings that use, handle or discharge hazardous products and materials;

(ii) a program to monitor closely the use and discharge of hazardous materials;

(iii) regular sampling of water, air and soil to protect against untimely manifestations of a risk or to identify any potential contamination that would prevent or limit the implementation of an evacuation strategy.

STAGE 3: SCRIPTING/SIMULATION/ANALYSIS:

During this stage, the environment ministry must do the following:

*1 - **Determine where** (in what sector or planning area) the disaster has been identified and what risk has materialized;*

*2 - **List and cross-reference the environmental components** of the stricken area or*

sector;

*3 - **Determine the consequences of the disaster** and the manifestation of the risk on the components of the sector or area:*
This sub-stage must assess how the disaster and the fact that the risk that produced it has materialized affect the environment in the sector struck by the disaster, according to the environmental factors listed under point 1 of stage 1;

*4 - In terms of the consequences and behaviour of the risk, **prepare scenarios for how the situation may evolve from an environmental quality point of view**:*
It is now time to determine how the situation might change. This means listing all the possibilities that could occur, taking into account the circumstances and conditions present (the risk manifested, its characteristics and the bio-physical and environmental context of the area affected).

*5 - **Simulate how the situation might evolve** (dynamic evaluation of the scenarios):*
Simulation software will help ascertain, in terms of the changing values assigned to the variables (presented in point 1 of stage 1), the possible fluctuations that each scenario might undergo, so that the situation can be followed as closely as possible and the strategy or protective measures that are the most appropriate in the circumstances can be established.

*6 - **Analysis of the systems and the risk**:*
In many cases the risk will be moving (spills, plumes and toxic fumes, etc.) and may affect more than one planning sector. The results of the simulations should be analyzed and an evaluation should be made of how the disaster and the risk will evolve or how likely a given phenomenon is to occur. This process should be repeated whenever new information is received that alters the basic data.

STAGE 4: DEVELOPING EMERGENCY RESPONSE SCENARIOS:
In this stage, the environment ministry should be able to give municipal decision-makers as specific and detailed a picture as possible of the situation prevailing in the disaster area in terms of the risks, their characteristics and components, which ones have appeared most frequently, what limitations there are, what problems should be anticipated, etc. Depending on the facts that have been observed with respect to actual or apprehended risks and their characteristics, the ministry could indicate which public safety or evacuation scenarios the decision-makers should favour.

STAGE 5: DETERMINING THE BEST RESPONSE SCENARIO (EVALUATING OPTIONS):
Although the environment ministry is not responsible for this, it may be asked to

take part in determining the best scenario for ensuring public safety. In this stage, the ministry, like the other responders, will by and large follow this procedure:

1 - Study of possible evacuation response scenarios;

2 - Analysis of actual secondary risks and their evolution over time: in terms of environmental repercussions on public well-being, this analysis is crucial;

3 - Choice of the best response scenario;

4 - Study of mitigation measures for secondary risks in the disaster;

5 - Proposal for mitigation measures appropriate for the chosen scenario.

STAGE 6: MAKING THE DECISION OR RECOMMENDATION:

The environment ministry will not intervene directly in this stage although it may, like the health responders, be consulted for that purpose because of the information it manages and the importance of environmental considerations. While the decision-makers decide on a public safety strategy, the ministry must continue to gather information and data so that it can inform the decision-makers, if need be.

STAGE 7: DISSEMINATION/IMPLEMENTATION OF THE DECISION OR RECOMMENDATION:

The ministry will have to follow up on the information it has and communicate new information and changes it has observed as they occur.

STAGE 8: FOLLOW-UP/MONITORING/EVALUATING THE CHOSEN RESPONSE STRATEGY:

The environment ministry will have follow up on the information it has and communicate new information and changes it has observed as they occur.

STAGE 9: REVISITING THE DECISION OR RECOMMENDATION:

Depending on how the work of ensuring public safety operation progresses in the field, the ministry will have to follow up on the information it has and propose alternative means in the event the initial strategy proves inadequate.

4.2.4 THE COMMUNICATIONS MINISTRY

The provincial communications ministry will play an advisory role for the municipal or metropolitan administration in terms of public communication. This aspect of the more general problems posed by an evacuation should not be overlooked, because insufficient or ineffective communications can prevent the public from carrying out the evacuation strategy

properly. They can also give rise to contradictory interpretations and lead to unexpected and unwanted behaviour or result in rumours aggravating the situation and needlessly complicating the conduct of operations. While the municipality is primarily responsible for its own communications strategy, it should call on the expertise and resources of the provincial ministry so that, along with its evacuation planning, it can work out an appropriate communications plan for use in the event of a disaster. This requires the following:

STAGE 1: CHARACTERIZING THE SYSTEM AT RISK (CITY OR URBAN AGGLOMERATION:

Communications directors will not be directly involved in characterizing the system at this stage. However, the information produced by the other departments (city planning, transportation, environment, among others) will be particularly useful to communications to help it better target the public it wishes to reach and articulate an effective and credible communications strategy. Its major task will be to develop appropriate communications tools for the circumstances so that the necessary information is directed towards disaster victims, the media and, more generally, the public at large. Thus, in anticipation of an evacuation operation, the communications directors (both in the municipality and from the ministry in question) will have to plan as follows:

1 - Identifying those in charge and specifying their tasks:
This is important when it comes time to implement a specific response strategy. While the other responders work directly under the general supervision of the municipal emergency measures co-ordinator, primarily in the planning and decision-making phases, the communications function will be active primarily in the response phase when it will disseminate information relative to the implementation strategy.

Consequently, the allocation of responsibilities between the municipality and the ministry is of prime importance. It must be determined who has responsibility for acting and when. Such specificity is required to avoid confusion in getting the message out. Normally, only municipal-decision makers designated in advance should be empowered to issue directives to broadcast or disseminate information. The provincial ministry should play a supporting role only and should await orders before disseminating material from the municipal official in question. **A service agreement between the municipality, the metropolitan administration and the provincial communications ministry should spell out the responsibilities of each party.**

2 - Identifying and characterizing the communications and information techniques that will be used in a potential evacuation operation:
This must be done at two levels. Communications directors should start by

organizing internal communications for use among the various responders. Then, special attention should be given to external communications, with the public in the disaster area, the media and the public at large.

(i) Internal communications:

Since internal communications mechanisms will already have been provided for in the emergency plans, this is only a brief reminder of the tools necessary for implementing that function. The tasks to be completed in this area include:

- the organization of a communications warning "tree" among responders;
- planning for rescue communications;
- planning for a message control centre;
- planning for fixed and mobile communications posts;
- the development and adoption of service agreements with local ham radio clubs concerning their possible involvement in an evacuation (the agreement should spell out their roles and responsibilities).

(ii) External communications:

Municipal and ministerial responders should agree on the communications and information techniques that should be used in an evacuation and the priority to be given to each so that the necessary information is disseminated at the right time. The most common techniques include:

- radio or TV messages;
- press releases;
- press conferences;
- media kits (consisting of press releases and other basic information on the disaster);
- electronic communications;
- forms (prepared texts with spaces to fill in as preliminary information documents when a disaster response is activated).

In addition, during the planning phase for an actual evacuation, it would be desirable if public information folders were prepared and disseminated among the population so that in normal times, when there is no disaster, the people could get an overall idea of what an evacuation is, what this extraordinary measure involves and the tasks and operations that disaster victims must carry out if the authorities recommend that they evacuate their homes.

3 - Preparing information documents (internal and external communications):

After selecting the techniques it will use in an evacuation, the communications work team must prepare versions of each kind of document or technique that it intends to use to disseminate information, whether internally or externally. Draft texts should

be prepared and corrected. More specifically, these documents must, in every case, meet the following criteria:

- **Accuracy**: The information presented must be accurate and verified. There must be no room for misunderstandings. The reader should know what it is about, what is happening and why the information is being disseminated;
- **Concision**: The information presented must be a synthesis, presented in as few words as possible. A disaster provokes reflex reactions on the part of responders, media and the public, and people do not have the time to integrate a vast quantity of information;
- **Objectivity**: The information on evacuation must indicate to those concerned what they should do and know. It is inappropriate to analyze the situation and its causes, and still less to identify the guilty party, denounce past actions or needlessly alarm the public. The facts should be presented without hypotheses or unsupported prognostications;
- **Timing**: The information should be presented at the right moment and be as up-to-the-minute as possible. Before disseminating a communications document, it should be ensured that no other new information has appeared that might change its substance or conclusions. It must also be remembered that the right information has to reach the right people.

4 - Developing agreements in principle with the media:

It is impossible to over-emphasize the importance for those managing a disaster of maintaining excellent relations with the media, spoken and written. The media can be a significant ally in a critical situation. Managers should therefore develop and sign agreements in principle with the media spelling out the role the media is expected to play in an evacuation and the facilities that the managers will make available to representatives of the press (press room, documentation centre, etc.). This can only improve relations between the municipality that will conduct the evacuation and the media who will keep disaster victims and the public at large well-informed about the situation.

STAGES 2 TO 6 (INCLUSIVE):

Communications resources have no tasks to do during these stages. They will, however, have to inquire about new developments in the analysis of the situation and the decision-making process, and hold themselves ready to disseminate information documents at the request of the emergency measures co-ordinator. If appropriate, the communications function can issue prepared information during stage 3, at the beginning of the disaster, in order to provide preliminary information on the situation and what the authorities intend to do.

STAGE 7: DISSEMINATION/IMPLEMENTION OF THE DECISION OR RECOMMENDATION:

As soon as the decision has been made, the communications function will be activated. It will have to work at two levels:

(i) at the request of the municipal emergency measures co-ordinator, it must **co-ordinate internal dissemination of the decision**, that is, inside the evacuation management structure. All responders who must know and apply the decision must be informed of how the chosen strategy will be implemented. The communications function must issue the required message(s) to the responders, depending on what is provided for in terms of implementing the warning plan. It is important that, even if internal dissemination of information does not have to respond to aesthetic and public relations imperatives as it does with the media and the public at large, the messages to be transmitted must nonetheless meet all the criteria presented earlier. Clarity and concision in an emergency is undoubtedly the primary criterion to consider in disseminating the decision internally;

(ii) next, **the information is disseminated externally**. This involves communicating in accordance with the directives provided for in the planning phase. Also, and especially, it is necessary to have a "plan of attack" for the media. It is important to ensure the collaboration of the latter as soon as the chosen measures to ensure public safety are announced, so that they can transmit official messages quickly and effectively to disaster victims and the public at large. In this perspective, disaster victims will be better able to understand the importance of paying attention to the situation and the directives that have been issued and reacting accordingly. Also, a specific and rigorous communications strategy, together with a positive media relations strategy, avo ds problems in the long run and potential glitches (exaggeration of information by the media, improvisation by the media in response to events, appearance of rumours, etc.).

STAGES 8 AND 9 (INCLUSIVE):

The communications function will have to make the necessary adjustments in terms of communications and information depending on changes made to the response strategy in the field. The same rules apply to the dissemination of information messages.

CHAPTER 5: CONDITIONS FOR IMPLEMENTATION AND CONCLUSIONS

The last chapter will briefly review the conditions for successfully implementing and applying the integrated approach proposed in this Guide. This strategic planning model does not claim to be exhaustive in itself, nor is its scope so broad as to make it universally applicable. On the contrary, the relevance and continuing applicability of the procedure depends far more on the political will of elected officials and the determination and thoroughness of managers and players than on the intentions of its designers. Also, it should be remembered that the model must be adapted to fit the circumstances of the municipality that decides to use it. Furthermore, certain minimum conditions must be met to ensure the success of this approach.

5.1 SEVERAL CONDITIONS FOR IMPLEMENTATION

In view of the sizable number of responders involved in an evacuation operation, the strategic planning model requires, as the primary condition for successful implementation, **that all players -- beginning with the municipal responders -- regard the planning process as one that depends on sustained multidisciplinary and collective effort.** It requires involvement by senior managers, with a clear mandate from the municipal council and a public decision to go ahead with planning for an evacuation. This condition also presupposes the implied acceptance by each player of the fact that he does not act alone, but must be aware of and take into consideration the roles of the other players. His own response must be integrated into the response of the other players. Moreover, to be successful, *the process must be accepted from the outset and recognized as necessary by all municipal responders* if it is to result in successful evacuation management.

The second condition flows directly from the first: **the players must maintain continuous relations among themselves, must stay in close contact to find innovative solutions to the questions and problems involved in the planning.** Constant improvement of the planning process may be in the form of repeated up-dates, exercises, simulations or any other form of evaluation that the planners consider relevant to make it more effective and functional.

The third condition for implementation requires the players to be willing to re-assess their usual evacuation response procedures and work tirelessly to improve their approach and response methods by adjusting their respective ways of doing things. It is very important that, where possible, the municipal players and the other responders try to standardize their planning procedures on the basis of a common model. In this way, the convergence on the ultimate goal of emergency planning -- ensuring public safety in the

event of a disaster --, will consistently yield good results. The model suggested is skeletal, to be sure, but putting it to the test, by adapting it, and by exercises and discussions among the responders in a given municipality, will be the best proof of its long-term effectiveness and relevance.

Another condition for implementation that has often been mentioned during presentation of the tasks is the quality of the characterization of the risks in a city or urban agglomeration. It is clear that the characterization of risks has a decisive effect on the rest of the evacuation planning approach that flows from it. Accordingly, evacuation planning is not just a list of things to do and co-ordinate. **It is first and foremost a function of the danger in a disaster situation. It requires an evaluation and analysis of the risks, not an automatic response to be plugged into emergency plans. Evacuation is only one way to ensure public safety and an analysis of the risks remains the fundamental condition for determining whether recourse to this method is desirable.**

On this subject, the authors feel it is important to include an additional element here, which will always be useful for analyzing risks and questions relative to evacuation planning. It consists of constant recourse to information technologies. As the means of communication and data processing become available, they will contribute to improving communication and will help activate evacuation procedures more rapidly and efficiently. Recent efforts in the area include the enormous progress that has been made in geomatics, or automatic geographic data processing. Its usefulness goes far beyond the strict bounds of cartography and may apply perfectly in the evacuation planning process (namely, in the scripting phase where hypotheses are devised for the evolution and behaviour of the risk, and in the analytical phase for evaluating possible response strategies).

Finally, the question of when the implementation of the planning proposed by this Guide will be most useful and effective should be addressed. **Ideally, the more quickly and rigorously the planning process is completed by a municipality, the more rapidly the final result can be evaluated. Apart from the simple question of time, the cities or the urban agglomerations that incorporate cities should ensure they have put in place the functions and departments needed to implement an integrated evacuation planning approach that can yield effective results.** It bears repeating that it is not essential to rely solely on the procedure described in this Guide. However, it is fundamental that the functions and tasks presented here be carried out by one of the players.

5.2 SOME CONCLUSIONS

In conclusion to this Guide, there are four things that must be remembered for a full understanding of the basic reasoning behind an evacuation. The subject is very complex and

by and large exceeds the strict confines of this Guide. However, the reader's understanding of the Guide will be enriched if he remembers its main conclusions.

The first is that evacuation is not just a response to a disaster or a major disturbance in the everyday life of a community. **Evacuation is a social phenomenon in itself with many characteristics and aspects that give it its meaning and significance.** Chapter 1 made it clear that, before going ahead with such a measure, the emergency planners and managers should weigh the pros and cons and assess all the surrounding circumstances. Such an approach not only lets the public become aware of the scope of the responsibilities that will be assumed by the municipal or metropolitan administration, but also allows elected officials to judge the real necessity of resorting to such a draconian strategy to ensure public safety. This is even more essential as evacuation is still, and always will be, an unpopular solution with the public.

Second, evacuation is a process that depends on many players and one where planning ahead of time makes the whole difference between success or failure. The responders on the ground in a disaster are numerous and diverse and play a variety of roles in an evacuation. This is not only because of the many facets of an evacuation, but also because of the context in which it occurs (population, territory, climatic and environmental situation), which requires a spectrum of responders and numerous experts. *Accordingly, meticulous and concerted planning is the best guarantee of success, ensuring that the evacuation can be adequately co-ordinated and lead to the desired result.*

Third, although the planning model in the Guide has been presented in a somewhat limiting and limited linear form, it is a logical approach to preparation for an evacuation based, as it must be, on three necessary phases: planning, decision-making and response. This model is adaptable to the various cities and urban agglomerations that are found in Canada. It will always require adaptation because of the appreciable differences among the urban territories. Although it was first designed with a view to serving as a reference approach to assist municipalities in planning a potential evacuation operation, it may be used as an agenda for carrying out an evacuation plan properly. Although it in no way claims to be perfect, the process proposed in this Guide has the flexibility needed to make it relevant and potentially applicable to numerous planning contexts.

In closing, the final conclusion that should be drawn from this Guide relates to the multiple tasks that will have to be carried out by the municipal responders and their external collaborators in conducting an evacuation. **Despite all the rereading and care put into describing the tasks, the descriptions are primarily indications of what should be done and organized. They cannot yield conclusive results except to the extent that they are based on a careful breakdown of the work to be accomplished and the establishment of a detailed agenda appropriate for that purpose. At the same time, there must be a**

constant exchange of techniques and information among the various players in order that the management of disasters and evacuation is integrated into the local culture as a feature of daily life. This last is certainly an ambitious wish, but it is also an organizational challenge, both complex and stimulating.

GLOSSARY

DANGER: A physical situation involving a risk of death, injuries, damage to property, harm to the environment, or a combination thereof (CSA, quoted in CUM, 1995: p. 5)

DISASTER: A serious event, actual or anticipated, caused by a fire, an accident, an explosion, a natural phenomenon or a technical failure, whether or not resulting from human intervention, which by its scale causes, or is likely to cause, death or injury, adversely affect human safety or cause serious damage to property or the environment (R.S.Q., c. 38.1).

EMERGENCY PLAN (OR EMERGENCY MEASURES PLAN): An essential component of the civil preparedness program of a municipality, a public service or a facility at high risk, it defines, structures and organizes the means and resources necessary for an effective response in a disaster or major disaster (CUM, 1995: p. 8).

ENSURING PUBLIC SAFETY: An action to protect human life, health and physical integrity against a risk, whether apprehended or actual, or any disaster situation.

EVACUATION: An operation whereby all or part of a particular population is temporarily relocated, whether spontaneously or in an organized manner, from a sector that has been struck by a disaster or is about to be struck by a disaster, to a place considered not dangerous for its health or safety.

EVACUATION PLAN: A supporting document for the emergency measures plan that is used to identify and organize the various responses aimed at evacuating persons exposed to a threat from an evacuation sector to a reception sector, while ensuring them a minimum of essential services on an emergency basis (CUM, 1995: p. 8).

FACILITATING FACTOR: A factor that, in combination with a risk, has the effect or reducing or slowing down the negative impact of that risk.

LIMITING FACTOR: A factor that, in combination with a risk, has the effect of accentuating or accelerating the negative impact of that risk.

MITIGATING MEASURES: Specific actions or measures designed to reduce the negative effects, whether apprehended or actual, of a risk in a disaster, or the difficulties related to the implementation of an evacuation strategy.

PLANNING SECTOR: A territorial unit corresponding to part of a municipality, identified for the purposes of emergency or evacuation planning and recognized for its urban planning,

demographic and environmental characteristics.

RISK: The probability that an unwanted specific event will occur during a given period of time or in specific circumstances. Depending on the circumstances, it may involve a frequency (the number of specific events per unit of time) or a probability (the probability of a specific event following a previous event) (Beaudette and Lacoursière, 1993: p. xiv).

A risk may be *apprehended*, that is, it constitutes a probability that an emerging phenomenon that may result in damage occuring. An *actual risk* is a state of affairs whereby the phenomenon that could result in damage is observable and actually experienced by those observing it. An actual risk may for this reason be considered as in the nature of a disaster.

RISK OF FAILURE: Probability that an administrative, technical or logistical element provided or integrated into a response strategy cannot be applied as a result of a lack of planning or a mistake.

SERVICES FOR DISASTER VICTIMS: All municipal "emergency social services" provided for in the event of a disaster or a major disaster whose purpose is to provide lodging, food and clothing for the evacuated population and to see to the registration of disaster victims, requests for information and their individual needs (CUM, 1995: p. 10).

URBAN AGGLOMERATION: A group of municipalities, whose centre is a city of major regional or national importance in economic, industrial, cultural or political and institutional terms, usually joined together in an urban community or metropolitan municipality.

VULNERABILITY: Estimate of the level of loss (from 0% to 100%) resulting from a disaster. This estimate takes into account the intrinsic characteristics of the apprehended area of impact (e.g.: population density, access, development, types of activities,...) and the state of preparation of the responders (CUM, 1995: p. 12).

BIBLIOGRAPHY/SUGGESTED READING

CSA: *Emergency Planning for Industry*, National Standard of Canada, in collaboration with MIACC, Rexdale, Ontario, CAN/CSA-Z731-M91, October 1991, 74 pages.

BEAUDETTE, J. and J.-P. LACOURSIÈRE: *Guide pour la préparation d'un plan de mesures d'urgence*, Montréal, Association Industrielle Laval Inc., Comité des mesures d'urgence pour l'est de Montréal (MUPEM), 1993, 202 pages.

CANADA, DEPARTMENT OF THE ENVIRONMENT: *Guide for Crisis Management Planning*, Ottawa, September 1993, 23 pages.

CANADA, EMERGENCY PREPAREDNESS COLLEGE: *The Collegeville Emergency Plan*, undated, 82 pages.

COMMUNAUTÉ URBAINE DE MONTRÉAL (BUREAU DE MESURES D'URGENCE): *Glossaire des termes utilisés dans la politique sur la coordination des intervenants en mesure d'urgence sur le territoire de la C.U.M. et dans les documents en découlant*, April 10, 1995, 12 pages.

FRANCE (Ministry of the Environment): *Le risque industriel*, 1994, 68 pages.

_____ : Le risque majeur, 1994, 72 pages.

_____ (Ministry of the Interior, Ministry of the Environment): Guide d'élaboration d'un Plan d'Opération Interne, Neuilly-sur-Seine, 1989, 32 pages.

HARKER, R.A. and A.E. WILMORE: *Emergency Evacuation Management Requirements and Concepts*, prepared for FEMA by Systan Co., Menlo Park, California, May 1981.

PERRY, R.. W.: *Comprehensive Emergency Management: Evacuating Threatened Populations*, Greenwich, Connecticut, JAI Press, 1985, 203 pages.

QUÉBEC, MINISTÈRE DE LA SÉCURITÉ PUBLIQUE (Direction générale de la sécurité civile): *La sécurité civile au Québec: Manuel de base*, Sainte-Foy, April 5, 1993, 137 pages plus appendices.

_____ : *La connaissance du milieu et l'étude de vulnérabilité*, Sainte-Foy, September 25, 1994, 65 pages.

APPENDIX: GENERAL TIMETABLE FOR PLANNING AN EVACUATION

Stages	Tasks to complete
STAGE 1 - Characterizing the system at risk (city or urban agglomeration)	- Prior involvement of senior managers and politicians; - Mandate setting out the municipality's desire to plan emergency and evacuation measures; - Political decision to plan for an evacuation; - Choice of a person to be in charge of organizing municipal emergency measures; * * * *1 - Identifying each sub-systems in the agglomeration (cities or districts/planning sectors):* - Partitioning the municipal/metropolitan area into planning sectors; - Inventory of all responders likely to take part in an evacuation: Security: -police; - firefighters; Health: - medical care; - public health; Environment; Transportation: - ambulance; - public transportation; - traffic; City/regional planning; Communications; Services to evacuees; - Enter into agreements with the municipal departments, provincial ministries and volunteer organizations that will work in a specific function in an evacuation operation; - Inventory of all functions and urban activities in each planning sector; - Inventory of the characteristics of the environment; - Cartography and general analysis of the road network and the components related to traffic in the planning area; - Identification of all transportation networks (public and private); - Identification of resources of police security, fire prevention, ambulance services, health and public health services and social services, and their various respective components within the planning territory and by sector; - Identification of responders able to provide services to evacuees, and their various respective components within the planning territory and by sector.
STAGE 1 (cont.)	*2 - Identifying and characterizing the components of each city and district (or planning sector):*

	- Identification and characterization of response resources in each field of activity, by planning sector; - Characterization of the components (urban activities, functions) of each city and each district (or planning sector); - Characterization of environmental components; - Characterization of the elements of the road network; - Characterization of the components (human and material resources) of all transportation networks (public and private); - Characterization of the components (human and material resources) of the police force, the fire department, ambulance services, responders providing services to disaster victims (registration and information, shelter, food, clothing, general services), social services, health and public health services, and their respective components; - Develop a communication plan adapted to evacuation: - specify the responsibilities of each responder in terms of communications; - identify the most effective communications techniques (internal and external communications); - prepare form documents for later communication; - prepare an agreement in principle with the media on communications.
	3 - Identifying and characterizing existing <u>risks</u> in each city and district (or planning sector): - Identify the risks primarily in the industrial sectors, networks of easements (high tension lines, gas networks, etc), the road network, the railway or maritime corridors, the airport areas and unused or poorly monitored areas; - Each responder (or group of responders) in a very specific field of activity must be able to identify risks that might be encountered directly and limit his action subsequently.
STAGE 2: Identification and analysis of sectors with high disaster potential (cities in the agglomeration or districts in the city)	*1 - Evaluation of facilitating factors and limiting factors in the sectors, for each risk identified:* In each planning sector, the department or function concerned will have to survey the facilitating factors and the limiting factors that could influence their later activity. Examples would include: <u>Facilitating factors</u>: - **emergency resources** present and available; - available **means of communication and warning**; - **urban infrastructures and easements** that make it possible to mitigate the threat and limit the number of

	people to be evacuated; - **certain characteristics or equipment that are at hand**; - **identification of traffic lanes with good traffic flow**; - **immediate alternatives for traffic**; - **human and material resources**; - **resources in time**; - **human and material resources available from a similar service near** the sector or the city affected by the disaster (in another city or community); - **time of the year, time of day and time in the week** when a disaster is declared. Limiting factors: - **characteristics of the bio-physical environment**; - **dimensions of buildings** and other characteristics; - **certain urban infrastructures and easements** (electrical and natural gas networks); - **nature of the disaster** itself; - **weather conditions**; - **presence of hazardous materials in an area of high disaster potential**; - **condition of traffic arteries**; - **physical obstacles to the movement of persons**; - **anticipated conflicts in using road and traffic arteries**; - **lack or inadequacy of safety equipment**, which can prevent or limit intervention in the disaster zone; - **human limitations on personnel if response effort lasts too long** : absenteeism, stress or panic, abandonment of posts, inability to find competent personnel or, conversely, a surplus of qualified persons or volunteers, etc.
STAGE 2 (cont.):	*2 - Study and evaluation of mitigation measures for each risk identified:* Each department or function should determine mitigation measures for the risks identified. The questions to be asked, in order to do this, are as follows: - What can be done to maximize the effects of the facilitating factors when a disaster strikes? - What can be done to curb the effects of the limiting factors when a disaster strikes? - Can the risks engendered by the disaster be provided for: where, when, how, how long and how much? If so, certain resources can be directed towards the places where a disaster is feared and actions to ensure public safety undertaken, including, among others, evacuation; - Can the consequences of the disaster be limited in the very short term? How can such consequences be

	eliminated or substantially reduced?
STAGE 3: Scripting/ simulation/analysis of the stricken area(s) and the risk that produced the disaster	Each department or function should do the following: 1 - Determine where (in which sector or planning area) the disaster has occured and what risk has materialized; 2 - List and cross-reference the environmental components of the stricken area or sector; 3 - Determine the consequences of the disaster and the materialized risk on the components of the sector or area; 4 - In terms of the behaviour of the risk, establish scenarios for how the situation might evolve from the point of view of environmental quality: 5 - Simulate the evolution of the situation (dynamic evaluation of scenarios): 6 - Analysis of the systems and risk.
STAGE 4: Developing emergency response scenarios for the disaster and for secondary risks and effects either present of anticipated (evaluating options)	The **police force**, **fire department**, **public transit and ambulance services** should prepare a list of the response options available to them respectively, taking into account the presence of facilitating factors and the availability of human and material resources. The departments or functions should be able to indicate, according to the most logical projections, their ability to respond in the response scenarios that are the most likely to be put into action. The **traffic department,** and the functions related to the **environment** and **public health** must be able to present as specific and detailed a picture as possible for the decision-makers regarding the situation prevailing in the area affected by the disaster. These departments will have to determine possible scenarios to ensure public safety, based on their information. Resources related to **providing services to disaster victims**, **social services**, **health** and **communications** do not have any specific scripting tasks to complete at this stage. However, they should be prepared to implement a response strategy.
STAGE 5: Determining the best response scenario according to the nature of the disaster and present or anticipated secondary risks (evaluating options)	The departments and agencies mandated in this stage, in conjunction with the emergency measures co-ordinator, act as follows: 1 - Study possible evacuation response scenarios 2 - Analyze actual secondary risks and their evolution over time; 3 - Choose the best response scenario;

	4 - Study mitigation measures for secondary risks in the disaster; 5 - Propose mitigation measures appropriate for the chosen scenario. The departments must continue to act as sources of information for the person(s) in charge of emergency measures.
STAGE 6: Making the decision or recommendation	Depending on who is made responsible for the emergency or evacuation plan (mayor, municipal emergency measures co-ordinator, fire chief, etc.), a final choice must be made as to the response that will be employed.
STAGE 7: Dissemination/ implementation of the decision or recommendation	*1 - Dissemination of the decision internally and externally:* *(i)* Internally: put warning and internal communications plans in place; *(ii)* Externally: deploy an "attack plan" for the media. Ensure media co-operation as soon as the public safety measures decided on have been announced so they can transmit official messages rapidly and effectively to disaster victims and the public at large. Use communications techniques and implement the measures provided for in the agreements between the authorities and the media on emergency communications.
	2 - Establishment of logistical measures to support evacuation operations: - Open a co-ordination centre, call on representatives of the responders, deploy desired resources for implementing the response strategy (police, firefighters, ambulances, public transportation, services to disaster victims, health), etc.
STAGE 8: Follow-up/ monitoring/ evaluating the chosen response strategy	The **emergency measures co-ordinator** first: - must ensure that the decision as to a response scenario is correctly applied by all responders concerned; - must check on the status of the situation with all the responders involved and assess their performance and that of the strategy in the field. The **other responders** communicate the information they have to the emergency measures co-ordinator as it becomes available.

STAGE 9: Revisiting the decision or recommendation	- Revisit the situation on the basis of the information provided by the responders and make changes as needed to the initial decision; - Transmit the changes in a timely fashion to the responders concerned.